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ABSTRACT

This student learning guide contains 30 modules for completing a course in welding. It is designed especially for use in secondary schools in Palm Beach County, Florida. Each module covers one task, and consists of a purpose, performance objective, enabling objectives, learning activities keyed to resources, information sheets, student self-check with answer key, performance test, instructional resources, and knowledge test. The 30 modules cover the following topics: performing bending operations manually; locating job openings; performing cutting operations with power equipment; welding single- and multiple-pass lap joints in true horizontal position; welding outside corner joints in flat position; welding butt joints in horizontal position; welding multiple-pass tee joints in true horizontal position; welding outside corner joints in horizontal position; welding single- and multiple-pass lap joints in vertical position; welding outside corner joints in vertical position; welding butt joints in vertical position; welding single- and multiple-pass lap joints in overhead position; welding multiple-pass tee joints in overhead position; gas welding carbon steel joints; repairing products from ferrous/nonferrous metals; setting-up and welding pipe joints; cutting carbon steel using oxy-fuel equipment; lead soldering ferrous and nonferrous metal; silver brazing copper pipe joints; brazing ferrous and nonferrous metals; gas welding cast iron; preparing pipe joints for welding; identifying metals by appearance and weight; setting up portable oxy-fuel equipment; running short beads; fabricating products from ferrous/nonferrous metals; participating in job interviews; performing punching operations with power equipment; welding multiple-pass tee joints in a horizontal position; and welding butt joints in flat position. (KC)

STUDENT LEARNING GUIDE

FL841311

ED255755

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

DUTY

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REVISED

PROGRAM: WELDING

DUTY: A COMPLETING CORE CURRICULUM

TASK: 1 1 Perform Bending Operations Manually

PURPOSE:

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Everyone has "straighten-out" paper clips. Have you ever tried to re-shape a paper clip its original shape? It is very difficult to do accurately.

You, the welder, must acquire skills that will enable you to shape metal into preplanned specified shapes. There are many methods of bending metal manually. This learning guide will help you develop skills in the more common methods used in industry. By gaining the basic fabrication skill of manual bending operation, your personal value to the welding industry will be greatly enhanced.

PLEASE DO NOT WRITE IN LEARNING GUIDE

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DEPARTMENT OF VOCATIONAL-TECHNICAL EDUCATION

North Technical Education Center
7071 Garden Road
Riviera Beach, Florida 33404

South Technical Education Center
1300 S. W. 30th Avenue
Boynton Beach, Florida 33435

West Technical Education Center
2625 State Road 715
Belle Glade, Florida 33430

E. Miles Bacon, Director of Vocational-Technical Education

Wilma McCarty, Curriculum and Staff Development Specialist

THIS STUDENT LEARNING GUIDE WAS DEVELOPED BY:

This student learning guide was adopted from the Decentralized Welding Project, Florida Department of Education by:

Vince Repper, Welding Instructor
North Technical Education Center

Jim Schmidt, Welding Instructor
South Technical Education Center

Joe Smith, Welding Instructor
West Technical Education Center

The format used in this student learning guide is one of the products developed through a grant from the Division of Vocational Education, Florida Department of Education which designated Ridge Vocational-Technical Center as a state demonstration site for competency-based vocational education.

OBJECTIVES

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PERFORMANCE OBJECTIVE:
(include condition, performance,
and standard)

GIVEN: access to equipment, tools, material and a blueprint,

YOU WILL: shape metal material manually.

HOW WELL: You must successfully complete the Knowledge Test.
Your performance will be assessed by your instructor using the Performance Standards on page 26.

ENABLING OBJECTIVES:

1. Recognize basic tools, fundamental procedures and safety in manual bending operations.
2. Prepare for manual bending operations.
3. Practice manual bending operations.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number PAGE 4 OF 28

Enabling objective

Recognize basic tools, fundamental procedures, and safety in manual bending operations.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify basic tools, fundamental procedures and safety in manual bending operations.	1. Instruction Sheet enclosed, Manual Bending Operations
2. Evaluate your knowledge using the Self-Check.	2. Self-Check enclosed.
3. Go on to Enabling Objective No. 2.	

DUTY
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Manual Bending Operations

Bending by hand can be accomplished simply by clamping a piece of metal in a vice and striking the extended portion with a hammer as illustrated in Figure 1 below.

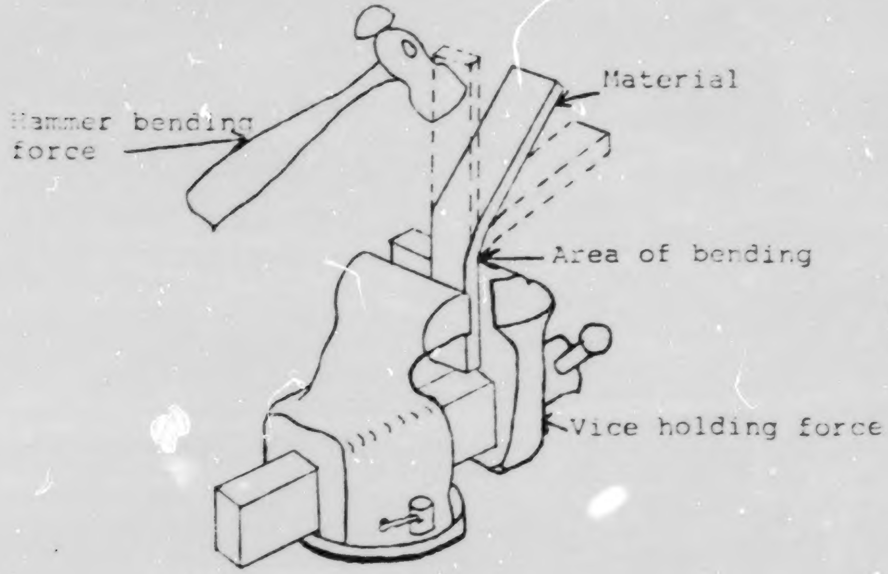


Figure 1

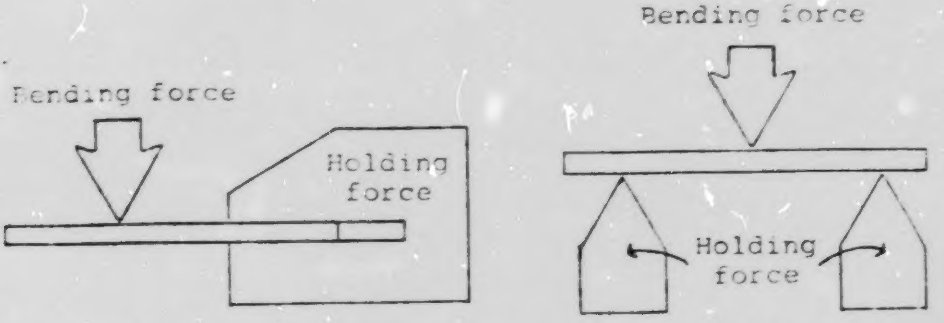
In the above figure, you will notice that a holding device (bench vice), a bending device (hammer), and material to bend is needed. In all manual bending operations, the following factors must be considered:

1. A method of holding the metal.

2. A method of applying the bending force.

3. The ductility (ease of bending) of the metal.

There are two basic methods of applying holding and bending force as illustrated in Figure 2 on the following page.



1. One-point holding 2. Two-point holding

Figure 2

In manual bending one of these two methods will be used. The forces described can be applied by several methods. These are listed below:

1. BENDING FORCES:
    - a. striking (hammer, sledges, and mallets)
    - b. pulling (chain falls, come-a-longs, and winches)
    - c. pushing (jacks, levers, push-pull jacks, and wedges)
    - d. gravity (weights and strength removal)
    - e. thermal contraction (control heating and cooling)

2. HOLDING FORCES:
    - a. clamping (vices, c-clamps, platens, wedges, etc.)
    - b. supporting (bars, bricks, pipes, wood blocks, dies, etc.)

Illustrated in Figure 3 on the following page are examples of these bending forces.

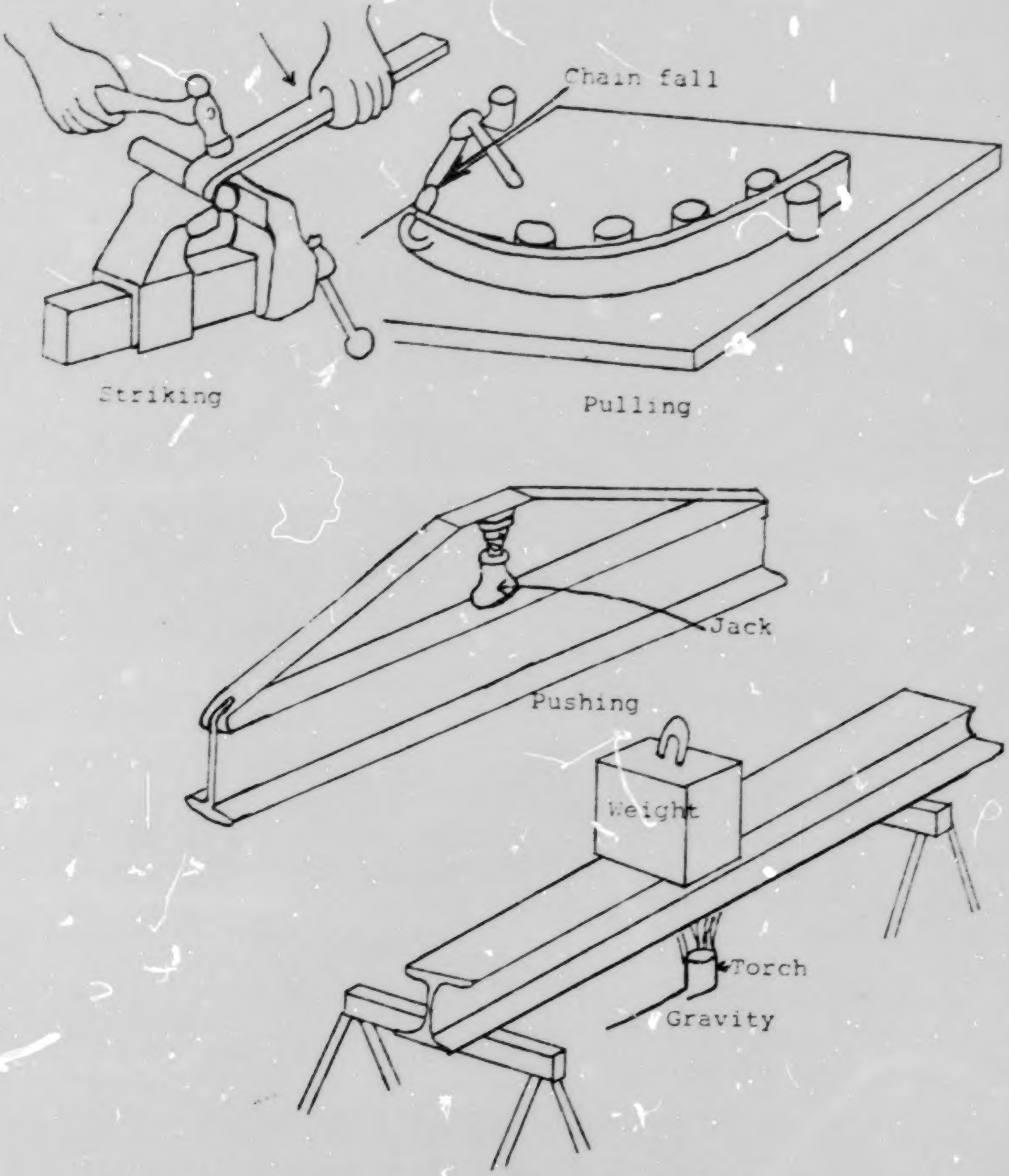

Chain fall
Striking
Pulling
Jack
Pushing
Weight
Torch
Gravity

Figure 3

cont.

Equipment for Bending

Heavy metal, such as strap iron, bars, or rods can be bent into angular and circular shapes with very little special equipment. Most metal projects made of heavy stock include some type of angular or circular bends. Metal up to 1/4" in thickness can be bent cold. Most angular bends can be made by using only a good metal vice and a ball peen hammer.

Some of the basic tools found in most shops that can be used for manual bending are:

1. Bench vice - holding force
2. Hammers - bending force
3. Pliers - holding and bending
4. Vice grips - holding and bending
5. Sledges - bending
6. Mallets - bending
7. Jacks - bending and pushing
8. Chain-falls - bending and pulling
9. Section of I-beams (various sizes) - holding shape
10. Torches - strength removal
11. Forges - strength removal
12. Bending forks - holding
13. Monkey wrenches - bending
14. Saw horses - holding
15. Section of pipes (various diameters) - holding
16. Dogs and wedges - holding and bending
17. C-clamps - holding
18. Welding platen - holding
19. Metal bending machines - bending and holding
20. Weights - bending

In most cases, you, the welder, can use your ingenuity to fabricate your own bending devices of scrap material found in your shop. An example of this is the bending fork illustrated in Figure 4 on the following page.

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Holes drilled into base block

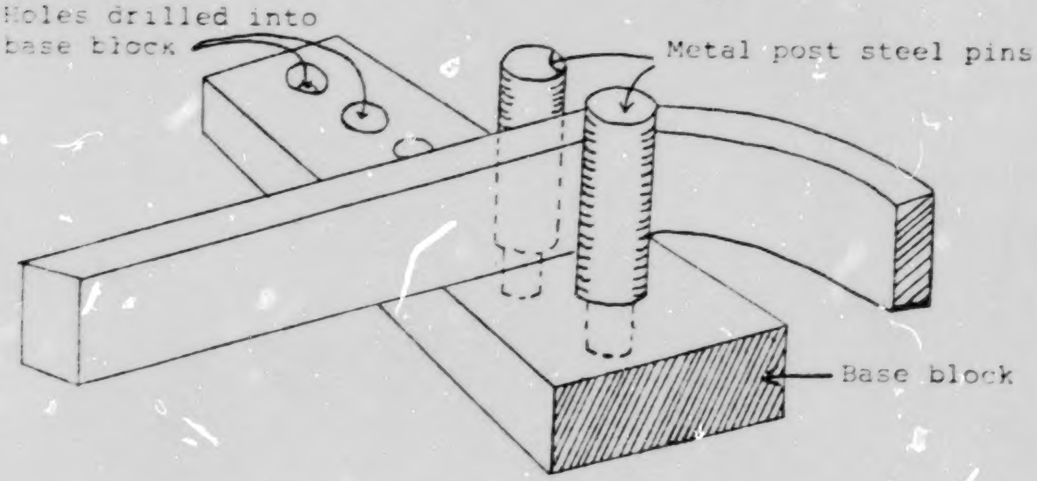

Figure 4

In the above figure, bending force is usually applied by hands, pushing or pulling on material to be bent.

Safety in Manual Bending Operations

As in any industrial shop procedure, the operation of performing bends manually has certain hazards that you must be aware of. These hazards all have the ability to inflict severe body injury. Let's examine some of these operations and identify these hazards.

Hazards in Bending with Striking:

1. injury to hand - mashed fingers
2. flying oxides or metal particles
3. head flying-off hammers, sledges, mallets
4. material being bent, slipping or falling out of holding
5. cramps or pulled muscles
6. bending metal that is extremely brittle
7. slipping or losing of balance
8. hazard to the casual observer

Hazard in Bending by Pulling:

1. slipping or losing your balance
2. "spring-back" injuries
3. accidental disconnection of pulling device

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4. unforseen fracture of material
5. falling equipment and tools or worker
6. failure of equipment under extreme tensile forces
7. flying missles that can cause eye and body injury
8. hazard to casual observer

Hazards in Bending by Pushing:

1. slipping or losing of balance
2. fracture of holding device
3. falling equipment, tools or worker
4. unforseen fracture of material
5. failure of equipment under extreme compression forces
6. slipping or disconnection of levers and wedges
7. hazard to the casual observer

Hazards in Bending by Gravity:

1. losing control of weights
2. burns from heated metal
3. losing supporting devices
4. hazard to the casual observer
5. potential for muscular injuries

Hazards by Thermal Contraction:

1. burns from heated material
2. burns from steam created in controlled cooling
3. eye injury from flying oxides
4. burns from uncontrolled heating source
5. falling material, tool or worker
6. slipping
7. hazards to casual observer

With all of these potential hazards you can see that it would be very easy to get hurt or injured. The safety precaution in all cases should be common sense. Eye protection, protective clothing, and removal of tripping hazards are just a few examples of what you can do to prevent accidents.

Instruction Sheet prepared by Joseph A. Jarreau

SELF-CHECK FOR ENABLING OBJECTIVE 1 number

PAGE 11 OF 28

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your knowledge by answering the items below on a separate sheet of paper.

The items below are True-False. Answer T if the item is True and F if the item is False.

1. Not all manual bending requires a holding device.
2. In manual bending, only one-point holding can be used.
3. Ductility of the material is important to consider when bending manually.
4. There are twelve basic methods of appling holding and bending forces.
5. In manual bending, the use of only the hands is intended.
6. Metal up to 1/4" thick can be bent cold.
7. Eye protection is not of much importance in manual bending due to low incidents of eye damage.

The items below are Multiple-Choice. Put the letter of the correct answer to the number of the question.

1. In manual bending, employing the use of gravity, which of the following will enhance gravitational forces?

   a. c-clamps
   b. weights
   c. bending forks
   d. bench vices

2. One-point holding as a method of bending requires bending force that is applied by:

   a. striking
   b. gravity
   c. pushing
   d. all of the above

3. Basic tools for manual bending operations:

   a. must be purchased specifically for that purpose.
   b. can be found in most shops.
   c. are hard to find.
   d. none of the above.

4. Manual bending is:

   a. uncommon
   b. occurring periodically
   c. not performed by combination welders.
   d. a routine skill used in fabrication.

5. The use of a heating source is used in:

   a. bending by striking.
   b. bending by pulling.
   c. bending by gravity.
   d. all of the above.

Now check your answers with the Answer Key.

SELF-CHECK FOR ENABLING OBJECTIVE 1
ANSWER KEY

number

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

True-False

1. F
2. F
3. T
4. F
5. F
6. T
7. F

Multiple Choices

1. b
2. d
3. b
4. d
5. d

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2

number

DUTY
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Enabling objective

Prepare for manual bending operations.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify steps in manual bending operations.	1. Instruction Sheet enclosed, Five Steps in Manual Bending
2. Evaluate your knowledge using the Self-Check.	2. Self-Check enclosed.
3. When you have the knowledge to attain this task, take the Knowledge Test.	3. Knowledge Test.
4. Go on to Enabling Objective No. 3.	

Five Steps in Manual Bending

There are five basic steps in performing manual bending operations:

1. Determine shape and dimensions of finished project.
2. Compensate for neutral axis.
3. Select method of manual bending.
4. Develop bend guides or template.
5. Bend material by selected method.

You must now examing elements of each of the above steps to understand how to apply them to a manual bending project. Let's look at each step individually.

Step 1

Determine shape and dimensions of finished project. The shape and dimension can be determined by either:

1. blueprints or working drawing (new work)
2. lifting templates or measuring (repair work)

Examples of these two are illustrated in Figures 5 and 6 following:

Blueprint or Working Drawings

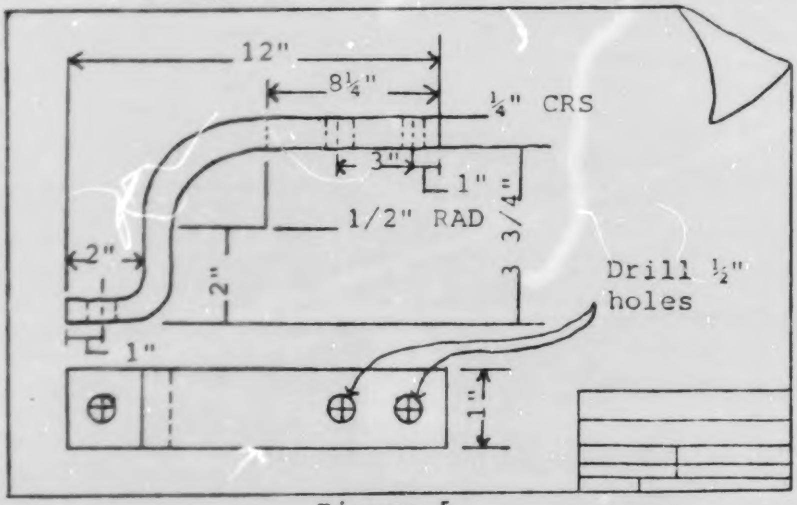


Figure 5

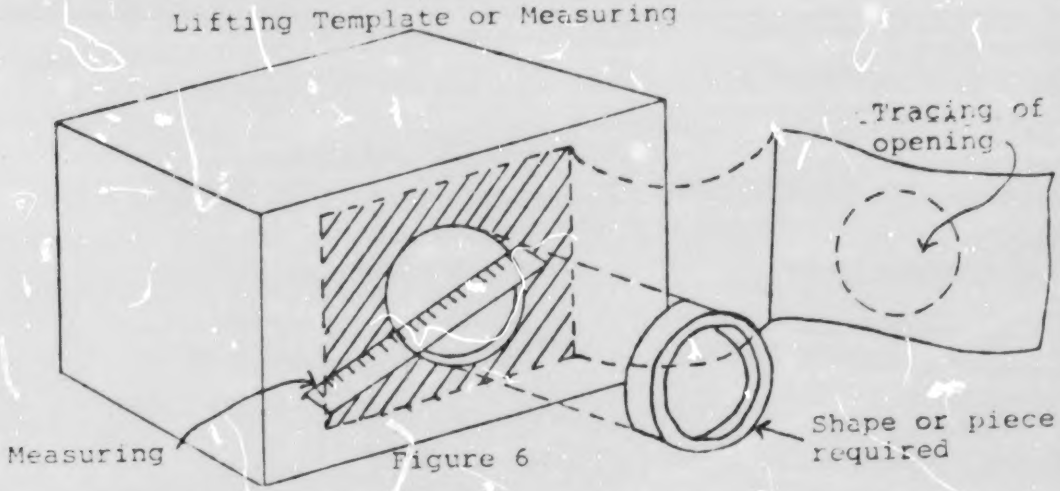
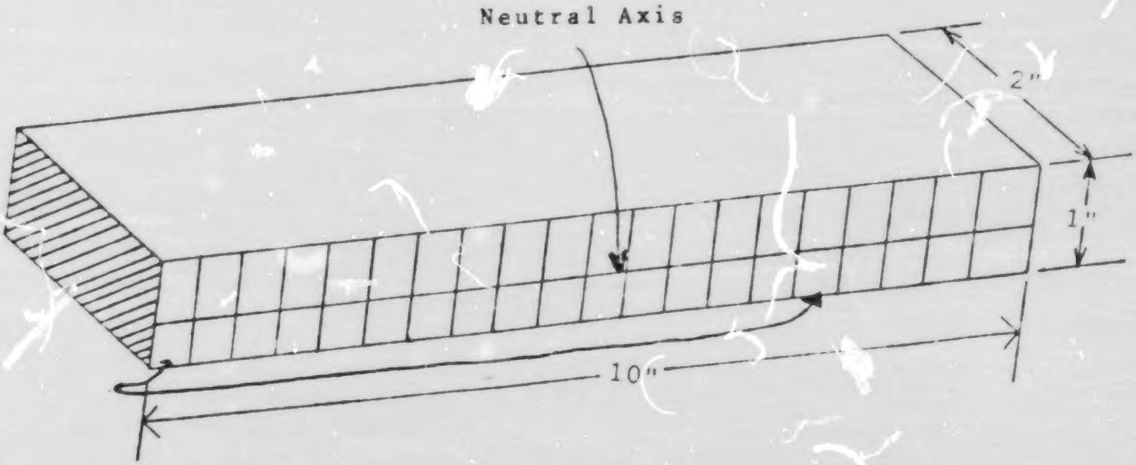

Lifting Template or Measuring
Tracing of opening
Measuring
Shape or piece required

Figure 6

Step 2: Compensate for Neutral Axis

The most common error in bending metal into a desired shape and dimension is failure to make bend allowance. This causes the metal project to be too large or too small and simply, it will not fit!

To understand this, we shall examine the neutral axis, how it acts in bending and how to make allowance for it. This is known in the welding trade as making bend allowances. Figure 7 below shows the location of the neutral axis in a bar of metal. Let's assume we wish to bend this stock at 90° in the center with a centerline radius of 2 1/4". Figure 8 on the following page illustrates how the centerline remains the same length.


Neutral Axis
2"
1"
10"

1/2" spaces for illustration purposes

Figure 7

After it is bent, the figure below shows what it would look like.

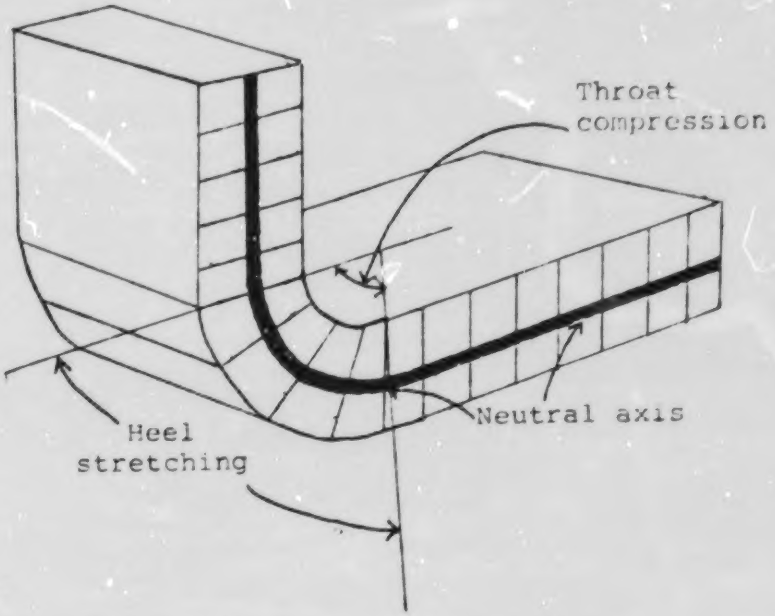


Figure 8

You will notices that in the area of bending, the spacing or material on the outside (heel) has been stretched while the material on the inside (throat) has been compressed. The neutral axis length has remained the same original length. To apply this principle in bending, let's use a project of forming a ring of 1" round stock, with an outside diameter of 6".

From the specification, you know that the inside diameter of the ring is 4", the neutral axis diameter is 5" and the outside diameter is 6". See Figure 9 on the following page.

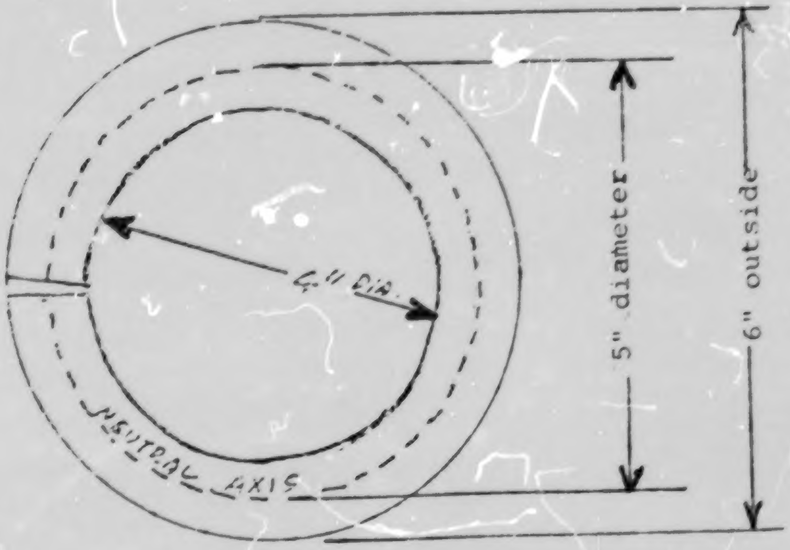


Figure 9

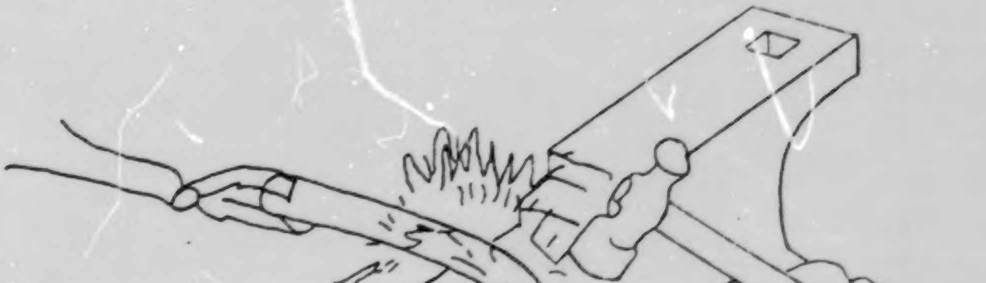
The neutral axis length will be unaffected in the bending process. Therefore, we calculate the length of material needed by using the neutral axis diameter or 5". See the example below.

Length of material = neutral axis diameter x PI
Length of material = 5" x 3.1416
Length of material = 15.702" or 15 11/16"

Step 3: Select Method of Manual Bending

In the above project, the 1" diameter stock cannot be bent cold manually. By heating the bar to "red" hot, it can be shaped around an anvil horn with a hammer as shown in Figure 10 below.

Figure 10



If the stock was 1/4" or less, no heat would be needed. You, the welder, must be able to select the most economical and practical method of performing the bend manually.

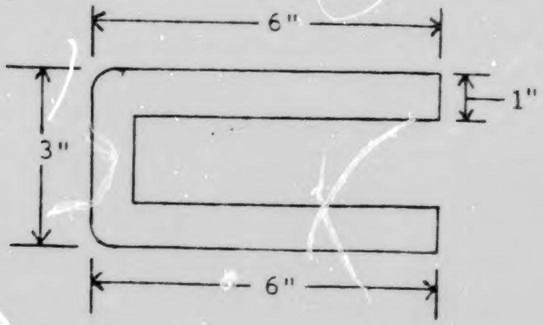
Step 4: Develop Bend Guides or Templates

A bend guide is any form that can be used to control the bend. In the example of the 6" outside diameter ring, a piece of 4" round stock would be ideal for a bend guide.

A bending template is simply a drawing or cutout in the shape of the desired bend to match with the project. This can be made of light gauge metal, cardboard or a simple soapstone drawing on heavy plate. A concrete floor will suffice in many manual bending operations.

Step 5: Bend Material by Select Method

For a review of this method, see Enabling Objective No. 1, Learning Activity No. 1.

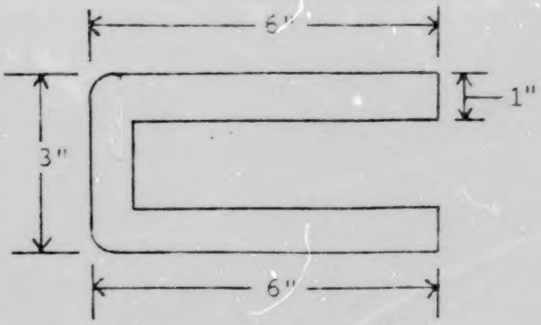


Instruction Sheet prepared by Joseph A. Jerreau.

DIRECTIONS:

Evaluate your knowledge by answering True or False to the items below on a separate sheet of paper.

1. Determining the shape and dimension of a finished project is always accomplished at Step # 5 in manual bending operation.
2. Compensating for a neutral axis is a mathematical function.
3. Lifting templates or measuring is best done from blueprints or working drawings.
4. The five steps in manual bending can be accomplished in reverse to speed up the process.
5. The most common error made in manual bending is failure to select the correct method for bending.
6. The neutral axis is located in the middle of the stock.
7. In manual bending, the heel of a bend is stretched while the throat shrinks.
8. In the drawing below, the length of stock needed to achieve the required dimension would be 14".



9. Heat cannot be used in manual bending.
10. Bend guides and templates can be developed by the welder.

Now check your answers with the Answer Key.

SELF-CHECK FOR ENABLING OBJECTIVE 2 number
ANSWER KEY

PAGE 21 OF 28

DUTY
TASK
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DEPT.
PROG.

1. F
2. T
3. F
4. F
5. F
6. T
7. T
8. T
9. F
10. T

All of your answers should agree with the answers in the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 3 number PAGE 22 OF 28

enabling objective

Practice manual bending operations.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to assemble needed equipment, tools, and material for manual bending.	1. Equipment checklist enclosed.
2. Lay out and cut material using Resource No. 2.	2. Exercise Sheet enclosed, Pipe Hanger Project
3. After layout and cutting, have instructor check your work before bending.	3. Instructor
4. Practice bending metal.	4. a. Equipment b. Tools c. Material
5. Evaluate your work using the Self-Check.	5. Self-Check enclosed.
6. When you are sure you can perform this task, take the Performance Test.	6. Performance Test.

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Equipment and Tools

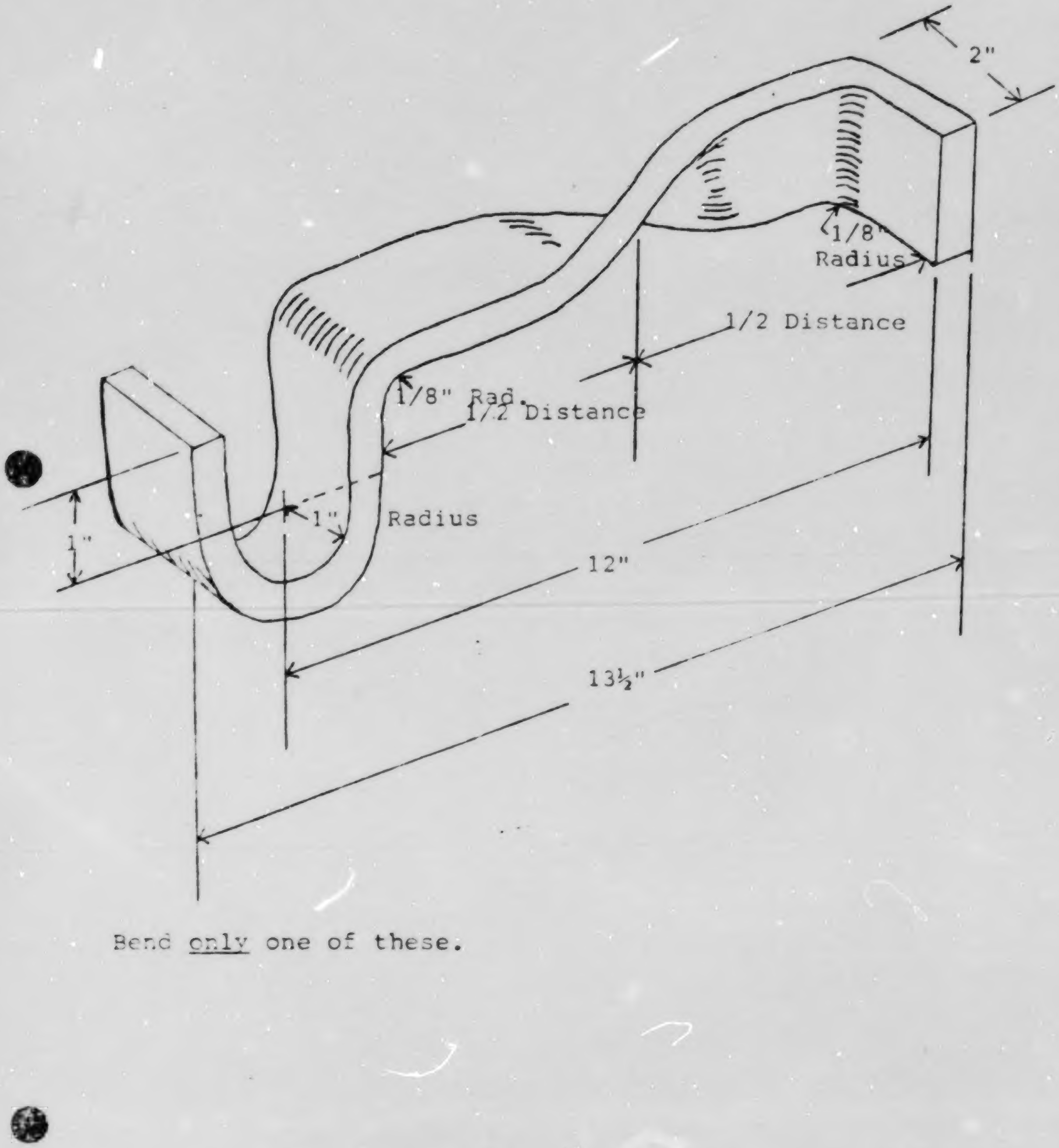
1. Bending fork
2. Vice
3. Ball peen hammer
4. Hacksaw
5. Oxy-acetylene torch (for heating)
6. Goggles
7. Gloves
8. Quenching tank
9. 2" round mandrel
10. Vice grip, tong, and pliers

Material

1. 1/4" x 1" x 2' hot rolled steel strap

Pipe Hanger Project

Illustrated below is a practice bending project.


2"
1/8" Radius
1/2 Distance
1/8" Rad.
1/2 Distance
1"
1"
Radius
12"
13½"

Bend only one of these.

SELF-CHECK FOR ENABLING OBJECTIVE 3

number

PAGE 25 OF 28

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet or paper.

All items should receive a "YES" response.

		YES	NO
1.	Was a throat radius of 1/8" (± 1/32") on the two 90° bends?......................	_____	_____
2.	Was the pipe hanger saddle portion 2" deep?	_____	_____
3.	Was the pipe hanger saddle shaped at a 2" diameter?.................................	_____	_____
4.	Was the twisted portion revolved 90°?....	_____	_____
5.	Was the twisted portion 1/2 the distance between the two 90° bends?..............	_____	_____
6.	Was the saddle bent 180°.................	_____	_____
7.	Was the finished project twisted in the same direction as illustrated on the Instruction Sheet?....................................	_____	_____

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ ☐☐
duty task number

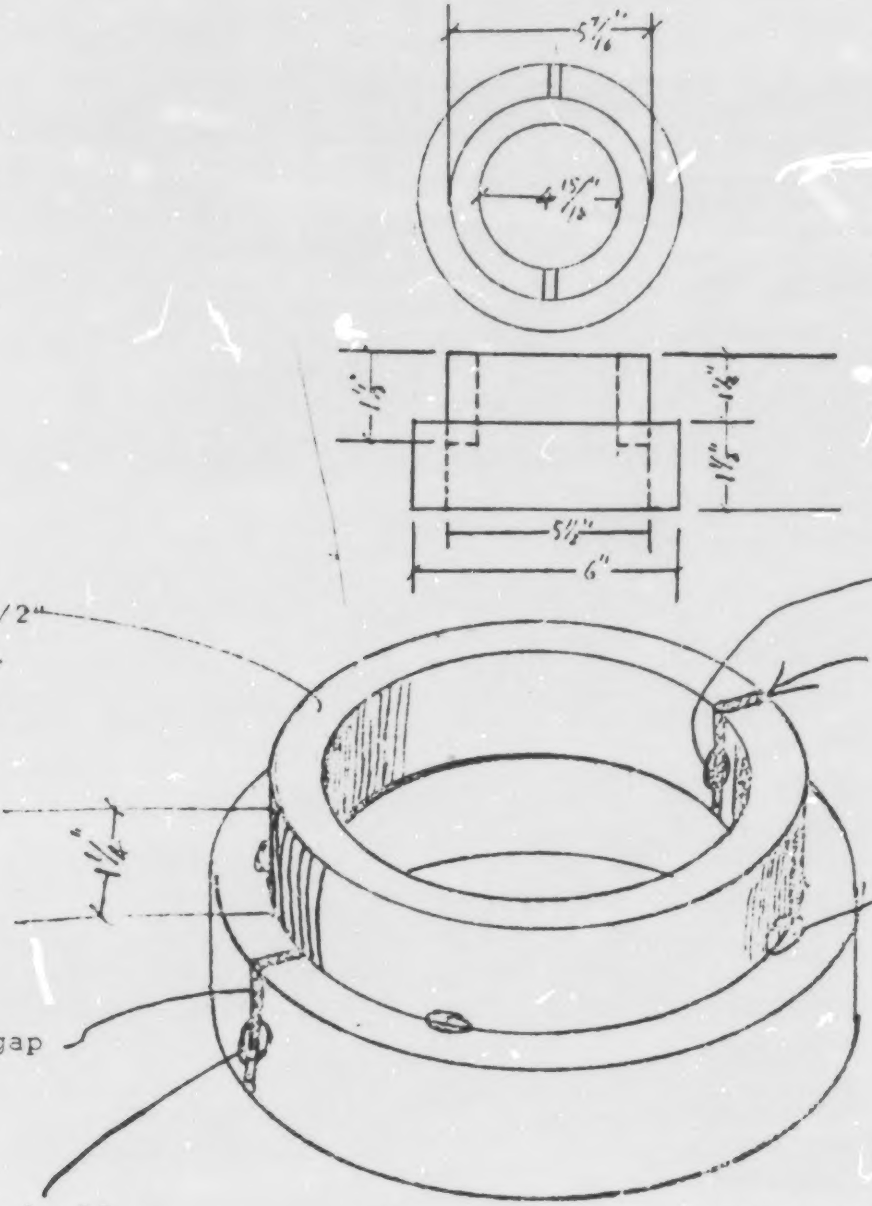
PAGE 26 OF 28

DIRECTIONS:

Given access to equipment, tools, material, and a blueprint, you will shape metal material by manual bending operations. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Was the larger band a 6" outside diameter?..........		
2. Were both bands perfect circles?..........		
3. Was the small band to where it could slip into or through the large band?..........		
4. Was a 1/8" space maintained at band connections?..........		
5. Were the gaps 180° apart?..........		
6. Was the total height 2 3/4" after tackwelding?..........		

DUTY
TASK
ATTEMPT
STUDENT
DATE
☐ Attained
☐ Not attained
EVALUATOR
DEPT.
PROG.


5 7/16"
4 15/16"
1 1/2"
1 1/8"
1 1/2"
5 1/2"
6"
1 1/4"

Material

1/4" x 1 1/2"
Hot-rolled
steel

Tackweld
inside

1/8" gap

Tack

1/8" gap

Tackweld
outside

Note: When fit is
proven, tack
in four spots
as specified.

LIST OF RESOURCES, MATERIALS, AND EQUIPMENT

PAGE 28 OF 28

DUTY

TASK

DEPT.

PROG.

Instructional Resources

Equipment

1. bending fork
2. vice
3. ball peen hammer
4. hacksaw
5. oxyacetylene torch
6. quenching tank
7. 2" round mandrel
8. vice grip, tongs, and pliers
9. arc welding equipment (for tackwelds)

Materials

1. 1/4" x 1" x 2'
2. 1/4" x 1 1/2" x 3'

KNOWLEDGE TEST FOR ☐ duty ☐☐ task number

PAGE 1 OF 2

DUTY
TASK
DEPT.
PROG.

TASK: Perform Bending Operations Manually

DIRECTIONS: successfully complete this test, all items must be answered correctly. For those items missed, see your instructor for a review, additional learning activities or re-testing. Answer the items on a separate Answer Sheet.

DO NOT MARK ON THIS TEST!

The items below are True-False. Circle the T if the item is True and the F if the item is False on the separate Answer Sheet.

1. A method of holding the metal is as important as the bending method.
2. Ductility can be increased by heating the metal.
3. Heating a piece of metal to "red hot" will increase its strength.
4. Ingenuity is helpful in performing manual bending operations.
5. Most tools used in manual bending are not specifically designed for that purpose.
6. A monkey wrench is a form of a bending fork.
7. Manual bending operations are preferred because there is no way you can be hurt.
8. The biggest danger in using heat to bend with is overbending due to the increased ductility.
9. There are seven basic steps in manual bending operations.
10. Compensation for a neutral axis is of major importance in controlling finish dimensions.
11. If a project is on a blueprint, manual bending operation cannot be used due to technical "mumbo-jumbo".
12. Neutral axis compensation is a function for the designer or draftsperson.

KNOWLEDGE TEST FOR ☐ ☐☐

ONTINUED duty task number PAGE 2 OF 2

DUTY | TASK | DEPT. | PROG.

The items below are Multiple Choice. Put the letter of the correct answer on the blank to the left of the number of the question on the separate Answer Sheet.

1. A tool that generates bending forces is called a

   a. bench vice.
   b. bending fork.
   c. saw horse.
   d. hammer.

2. Scale or slag that pops off the surface of metal being bent is:

   a. a sign of fracturing.
   b. of no importance.
   c. an eye hazard.
   d. the shifted neutral axis.

3. When using a striking tool for a bending force, heat can:

   a. not be used.
   b. be used.
   c. be used but will not help.
   d. be applied to the striking force.

4. The welder performing a bending operation is partly responsible for:

   a. quality of the job.
   b. protection of the casual observer.
   c. blueprint reading.
   d. bending that requires use of a torch only.

PERFORM BENDING OPERATIONS MANUALLY

ANSWER KEY

Multiple Choice questions

.__d__ 1.
.__c__ 2.
.__b__ 3.
.__b__ 4.
.____ 5.

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True-False questions

[✓ T] F 1.
[✓ T] F 2.
T [✓ F] 3.
[✓ T] F 4.
[✓ T] F 5.

[✓ T] F 6.
T [✓ F] 7.
T [✓ F] 8.
T [✓ F] 9.
[✓ T] F 10.

T [✓ F] 11.
T [✓ F] 12.
T F 13.
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Matching questions

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STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: A COMPLETING CORE CURRICULUM

TASK: 1 8 Locate Job Openings

DRAFT

PURPOSE:

The job search begins with finding out what you need to know when you look for a job. Job hunting is a lot easier if you know where to look. This learning guide will identify three sources to consult when looking for a job.

DUTY A
TASK 18
PREREQ.
DEPT. IN
PROG. 9943
REVISED

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North Technical Education Center
7071 Garden Road
Riviera Beach, Florida 33404

South Technical Education Center
1300 S. W. 30th Avenue
Boynton Beach, Florida 33435

West Technical Education Center
2625 State Road 715
Belle Glade, Florida 33430

E. Miles Bacon, Director of Vocational-Technical Education

Wilma McCarty, Curriculum and Staff Development Specialist

THIS STUDENT LEARNING GUIDE WAS DEVELOPED BY:

Vince Pepper, Welding Instructor
North Technical Education Center

Jim Schmidt, Welding Instructor
South Technical Education Center

Joe Smith, Welding Instructor
West Technical Education Center

This student learning guide was adapted from the VIMAS Decentralized Welding Project funded through the Florida Department of Education.

The format used in this student learning guide is one of the products developed through a grant from the Division of Vocational Education, Florida Department of Education which designated Ridge Vocational-Technical Center as a state demonstration site for competency-based vocational education.

OBJECTIVES PAGE 3 OF 8

DUTY A | TASK 18 | DEPT. IN | PROG. 9943

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: access to a newspaper, employment agency, and job sites,

YOU WILL: locate job openings.

HOW WELL: Your performance will be assessed by your instructor using the Performance Test on pages 6-7.

ENABLING OBJECTIVES:

1. Read the want ads.
2. Use employment agenices.
3. Visit job sites.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number PAGE 4 OF 8

DUTY A
TASK 18
EN. OBJ. 1
DEPT. IN
PROG. 9943

Enabling objective:

Read the want ads.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify the procedure for reading the want ads.	1. Employability Skills Series: "Your Job Search", pages 34-35.
2. Evaluate your knowledge by completing Resource No. 2.	2. Employability Skills Series: "Your Job Search", pages 36-37.
3. Read Resource No. 3 to identify the abbreviations used in the want ads.	3. Employability Skills Series: "Your Job Search", pages 39-40.
4. Evaluate your knowledge by completing Resource No. 4.	4. Employability Skills Series: "Your Job Search", pages 41-42.
5. Go on to Enabling Objective No. 2.	

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 5 OF 8

DUTY A
TASK 18
EN. OBJ. 2
DEPT. IN
PROG. 9943

Enabling objective:

Use employment agencies.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify the procedure for using employment agencies.	1. Employability Skills Series: "Your Job Search", pages 21-23.
2. Complete Resource No. 2 as an exercise in using employment agencies.	2. Employability Skills Series: "Your Job Search", pages 25-26.
3. Evaluate your knowledge by completing Resource No. 3.	3. Employability Skills Series: "Your Job Search". pages 27-28.
4. Go on to Enabling Objective No. 3.	

PERFORMANCE TEST FOR A 1 8

duty task number

PAGE 6 OF 8

DIRECTIONS:

Given access to an employment agency, job site, and/or a newspaper, you will choose one and conduct a job search. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
Newspaper		
1. Was classified section of newspaper obtained?........		
2. Was type of job underlined?........		
3. Was amount of pay underlined?........		
4. Were working hours (if listed) underlined?........		
5. Was work experience required (if listed) underlined?........		
6. Was education or training (if listed) underlined?........		
7. Was personal equipment required underlined (if listed)?........		
Employment Agency		
1. Was fee determined?........		
2. Was procedure determined if you were fired or quit before fee was paid?........		
3. Was procedure determined for paying fee?........		
4. Was it determined under what conditions you would get your money back if the job did not work out?........		
Job Sites		
1. Were you prepared for an on-the-spot interview?........		
2. Were you alone for the visit?........		

DUTY A
TASK 18
ATTEMPT
STUDENT
DATE
☐ Attained
☐ Not attained
EVALUATOR
DEPT. IN
PROG. 9943

PERFORMANCE TEST FOR A | 1 8

CONTINUED duty task number

PAGE 7 OF 8

PERFORMANCE STANDARDS

ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
3. Were you dressed appropriately?		
4. Was the personnel department or person in charge identified and consulted?		
5. Was your name stated clearly?		
6. Was your reason for being at the site stated?		
7. Was handshake firm?		
8. Was your experience/qualifications stated?		
9. Was request made to have your name placed on file for future openings?		

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DUTY A
TASK 18
ATTEMPT
STUDENT
DATE
☐ Attained
☐ Not attained
EVALUATOR
DEPT. IN PROG. 9943

DUTY A
TASK 18
DEPT. IN
PROG. 9943

Instructional Resources

State of Florida, Department of Education, Employability Skills Series: Your Job Search, State of Florida, Department of State, Tallahassee, Florida, 1977.

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

DUTY

TASK

PREREQ.

DEPT.

PROG.

REVISED

PROGRAM: WELDING

DUTY: A COMPLETING CORE CURRICULUM

TASK: 1 3 Perform Cutting Operations with Power Equipment

PURPOSE:

Many types of power equipment are used for cutting operations. However, they will employ the principles of sawing and shearing identified in this learning guide. You will develop the skills necessary for performing cutting operations with power equipment.

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E. Miles Bacon, Director of Vocational-Technical Education

Wilma McCarty, Curriculum and Staff Development Specialist

THIS STUDENT LEARNING GUIDE WAS DEVELOPED BY:

This student learning guide was adopted from the Decentralized Welding Project, Florida Department of Education by:

Vince Repper, Welding Instructor
North Technical Education Center

Jim Schmidt, Welding Instructor
South Technical Education Center

Joe Smith, Welding Instructor
West Technical Education Center

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DUTY	TASK	DEPT.	PROG.

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: access to equipment, tools, materials, blueprint, and a work station,

YOU WILL: perform cutting operations with power equipment.

HOW WELL: You must successfully complete the Knowledge Test. Your performance will be assessed by your instructor using the Performance Test on page 17.

ENABLING OBJECTIVES:

1. Recognize fundamental operation, steps and safety procedures in operating power cutting equipment.
2. Practice cutting operations with power equipment.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1
number

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Enabling objective

Recognize fundamental operation, steps and safety procedures in operating power cutting equipment.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the operation of power equipment and the procedure for shearing.	1. a. Operator's Manual for Shearing Equipment. b. Instruction Sheet enclosed, Safety c. Instruction Sheet enclosed, Steps in Power Shearing
2. Complete the Self-Check.	2. Self-Check enclosed.
3. When you think you can attain this task, take the Knowledge Test.	3. Knowledge Test.
4. Go on to Enabling Objective No. 2.	

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 1 number PAGE 5 OF 19

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Safety

1. Be sure work area is clear of obstacles which may cause you to trip or fall.

2. Be sure all guards are in place.

3. Be sure bed is clear of all hand tools.

4. Be sure power is off while setting up machinery.

5. Keep observers clear of work area.

6. Be sure all fingers are clear of blade and hold downs.

7. Be sure dropping area of shear is clear of workers.

8. Be sure all interlocks are in place.

9. Be throughly familiar with procedures in Operator's Manual.

10. Wear gloves while handling metal.

11. Be sure cut material is stacked neatly to avoid slipage or spillage of material.

Steps in Power Shearing

Power shears are available in several different sizes, capacities, styles, and cutting principles. In addition, power shears are also designed for some specific function such as squaring cuts, circular cuts, notching cuts, nibblig cuts, and slitting cuts.

The term power shear is generally interpreted as a shear using electrical power. However, since squaring, notching, and circular cutting shears use manual power of such a mechanical advantage they must be treated as power shears.

Figure 1 shows the basic manual powered squaring shear.

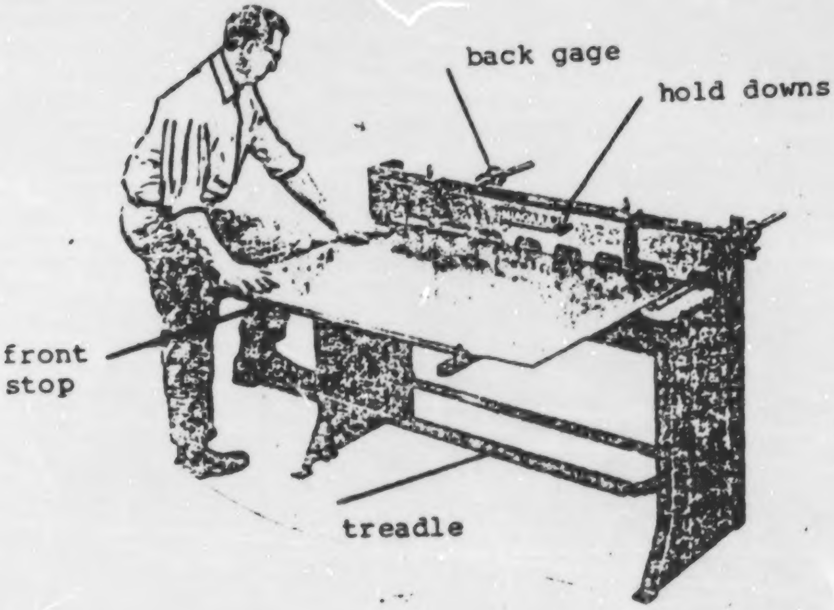
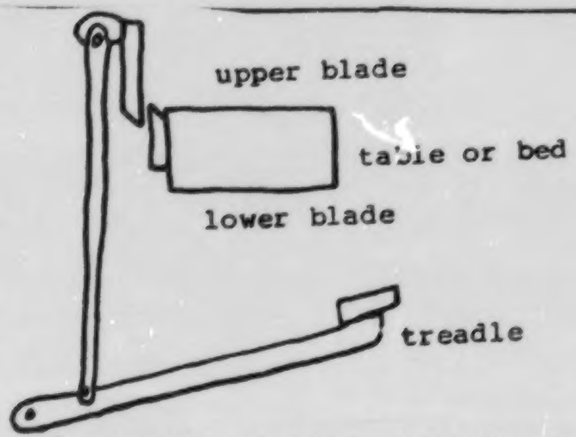
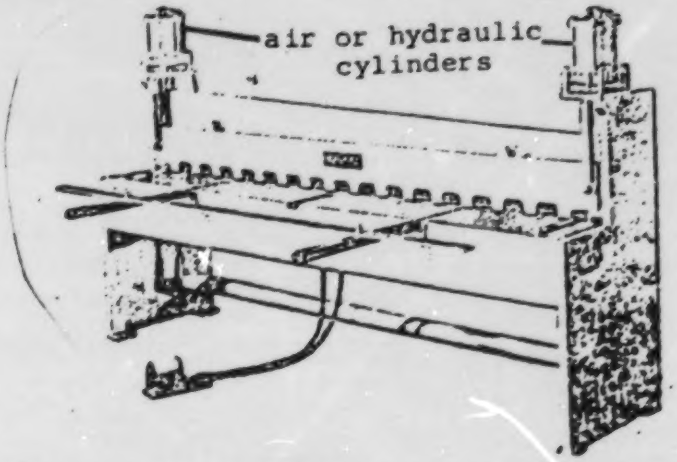


Illustration reproduced with permission from Niagara Machine and Tool Works, Buffalo, New York.

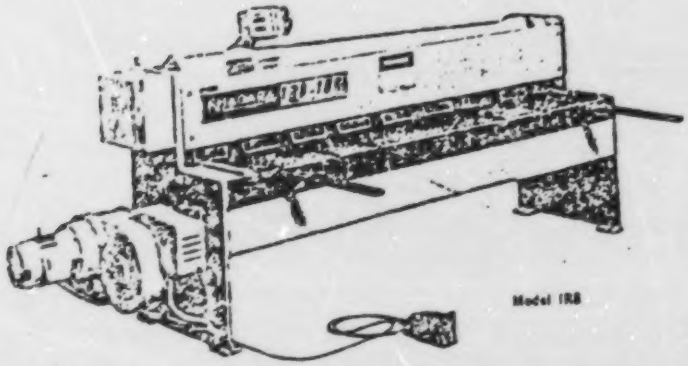
The foot operated squaring shear is generally limited to light gauge (thin) sheet metal. It employs the principle of the "guillotine" and is lower powered as illustrated by the Figure on the following page.


upper blade
table or bed
lower blade
treadle

A second type of powered squaring shear is the air powered squaring shear.


air or hydraulic cylinders

A third type of power shear is the mechanical powered shear. The mechanical powered shear cannot be stopped in the middle of a cycle or cut. Both the foot operated and air or hydraulic powered shear can be stopped in the middle of a cycle or cut.


NIAGARA
Model 1R8

Illustrations reproduced with permission from Niagara Machine and Tool Works, Buffalo, New York.

Other than the method of power all the squaring shears illustrated have the following similarities or components.

1. bed
2. housing
3. cross head
4. cutting blades
5. cutting blades
6. side gage
7. safety guard
8. bevel gage
9. extension arms
10. bed graduation
11. back gage
12. bed graduation
13. method of power
14. a limiting capacity
15. blade clearance adjustment

Steps in Power Shearing

The Figure below identifies each component.

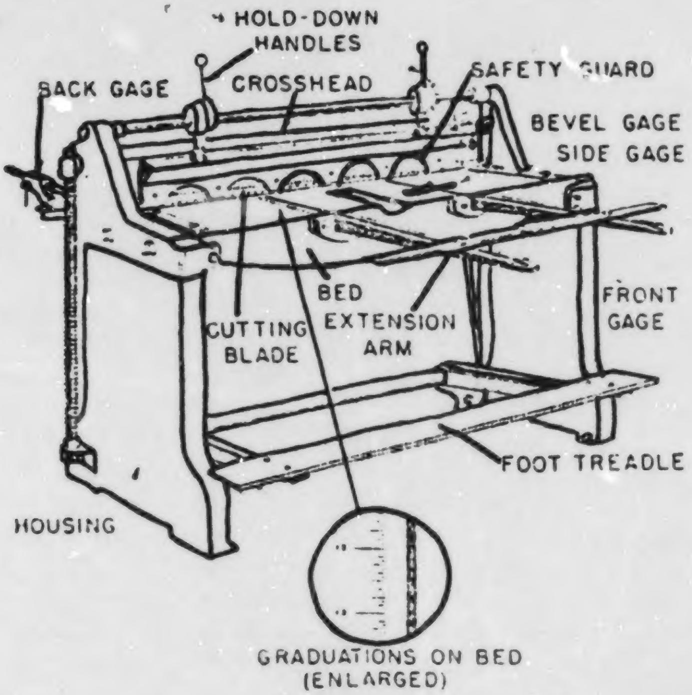
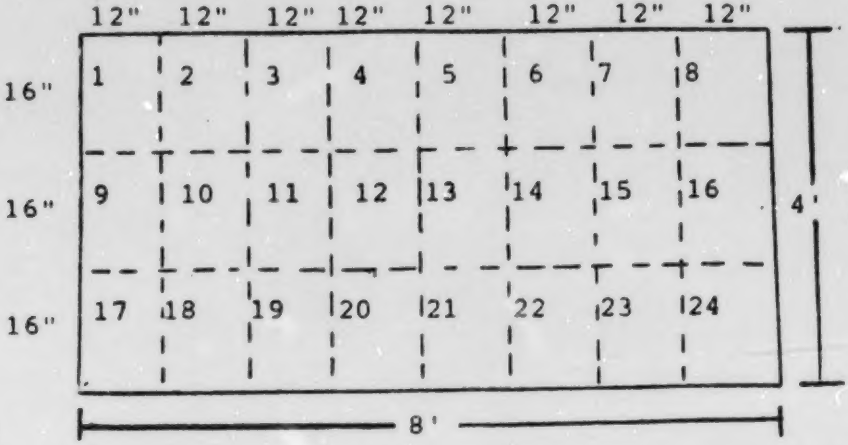

HOLD-DOWN HANDLES
BACK GAGE
CROSSHEAD
SAFETY GUARD
BEVEL GAGE
SIDE GAGE
BED
CUTTING BLADE
EXTENSION ARM
FRONT GAGE
FOOT TREADLE
HOUSING
GRADUATIONS ON BED (ENLARGED)

Illustration reproduced with permission from Niagara Machine and Tool Works, Buffalo, New York.

In order to develop skill in power shearing, take the job of a cutting 1 sheet of 1/8" thick, black iron into rectangles of 12" x 16" with the job requiring 24 of these rectangles.

First, determine what size of sheet will be needed to produce the total number of rectangles needed. NOTE: Sheets or plates usually come 3' or 4' wide and 8', 10' and 12' in length. Illustrated below are two possible solutions.

Solution 1


12"
12"
12"
12"
12"
12"
12"
12"
16"
16"
16"
1
2
3
4
5
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8
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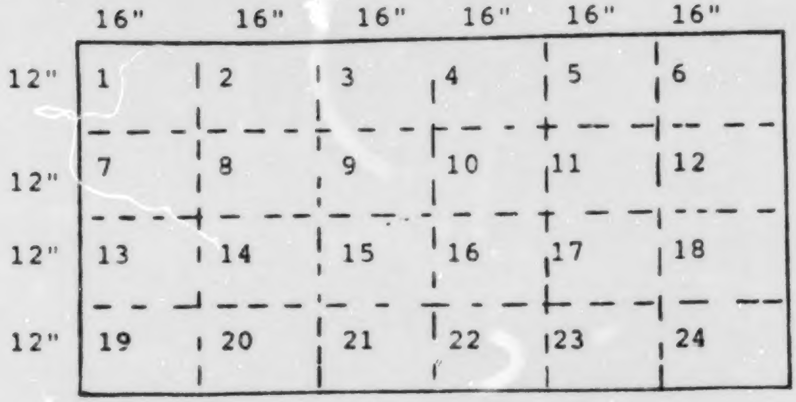
18
19
20
21
22
23
24
4'
8'

Solution 2


16"
16"
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Both solutions use a 4' x 8' sheet and there is absolutely no waste.

Steps in Shearing

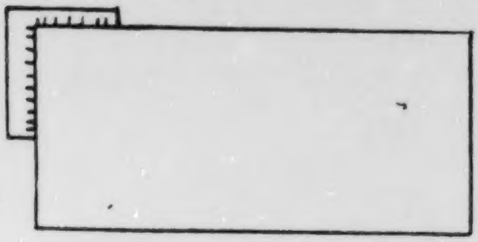
Step 1: Plan cut to eliminate or reduce waste to a minimum.

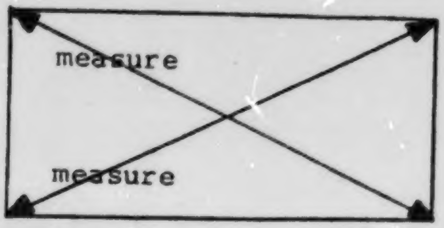
The planning of cuts is based upon the assumption that the sheet is perfectly square. The metal worker must never assume sheet have square edges. You must check each one to ensure squareness.

Step 2: Check squareness of sheets or plate.

Squareness can easily be checked by: using a framing square or using diagonal measurements.

framing square





Step 3: Set back gauge for required cut.

Step 4: Make 1st cut.

Step 5: Collect droppings and rearrange for next cut.

Step 6: Reset back gauge for second cut.

Step 7: Make final cut.

Step 8: Collect parts, stack, and label.

Step 9: Shut down and clean up.

SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 11 OF 19

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your knowledge by answering True or False to the items below on a separate sheet of paper.

1. All power shears use electrical power.
2. Power shears are rated by the thickness of metal that they will cut.
3. All shears (squaring) have similar parts.
4. The planning of cuts is not important when using squaring shears with power actuated back gages.
5. Dropping in shearing is a term used to indicate the amount of waste.
6. The sequence of steps in power cutting can be rearranged to suit your personal style.
7. You should not wear gloves while handling material for shearing because you lose sensitivity in your finger tips.

Now check your answers with the Answer Key.

LF-CHECK FOR ENABLING OBJECTIVE 1 number
NSWER KEY

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

1. F
2. T
3. F
4. T
5. F
6. F
7. F
8. F
9. F
10. F

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number PAGE 13 OF 19

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Practice cutting operations with power equipment.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read the Resource No. 1 to assemble needed equipment, tools and materials for power cutting operations.	1. Instruction Sheet enclosed, Equipment List
2. Prepare equipment and materials for cutting using the procedure outlined in Resource No. 1.	2. a. Equipment b. Material
3. Practice cutting operations with power equipment. Have your instructor check your work.	3. Instruction Sheet enclosed, Power Shearing
4. Complete the Self-Check. Have your instructor check your work.	4. Self-Check enclosed.
5. When you think you can perform this task, take the Performance Test.	5. Performance Test.

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Equipment List

Obtain the following materials from your locker or tool crib:

1. Framing square
2. Gloves
3. Tape measure
4. Safety goggles

Obtain the following from the metal storage area:

1. 1/4" x 2" strap iron 20' 0" long
2. 2' x 4' 16GA black iron sheet
3. 4"x 20' 0" x 3/8" black iron

Obtain rolling shop table.

Place metal on table in a flat position.

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 2 number PAGE 15 OF 19

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Power Shearing

Perform the following cutting operations:

1. With the 1/4" x 2" x 20' 0" strap iron cut 20 pieces of 2" x 6"
2. With 2' x 4' x 16 gauge black iron cut 96 pieces 2" x 6"
3. With the 4" x 20' 0" x 3/8" black iron cut 20 pieces 4" x 6"

REMEMBER: SEE INSTRUCTOR BEFORE CUTTING!!

SELF-CHECK FOR ENABLING OBJECTIVE 2 number PAGE 16 OF 19

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.
All items should receive a "YES" response.

	YES	NO
1. Were 136 pieces obtained?..............	______	______
2. Were all 1/4" thick stock finished to 2"x6"?................................	______	______
3. Were all the 16 gauge finished to 2"x6"................................	______	______
4. Were all the 3/8" stock finished to 4"x6"?................................	______	______
5. Were all pieces stacked separate and in a manner to avoid spillage?............	______	______
6. Was waste eliminated?..................	______	______
7. Were materials and tools restored?.....	______	______

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

RFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 17 OF 19

RECTIONS:

Given access to tools, equipment, and work station, you will perform cutting operations with power equipment. You will be evaluated for attainment of this task, based upon the items listed below.

ERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were all pieces cut to the dimensions specified?		
2. Was waste eliminated?		
3. Were all pieces square?		
4. Was project finished as required?		

DUTY
TASK
ATTEMPT
STUDENT
DATE
☐ Attained
☐ Not attained
EVALUATOR
DEPT.
PROG.

KNOWLEDGE TEST FOR ☐ ☐☐

duty task number

PAGE 18 OF 19

DUTY

TASK

DEPT.

PROG.

TASK Perform Cutting Operations with Power Equipment

DIRECTIONS:

Evaluate your knowledge by putting the letter of the correct answer on a separate sheet of paper.

1. Power shears are available in several different:

   a. makes, models, kinds, and colors.
   b. sizes, capacities, style, and cutting principles.
   c. manufacturers, functions, direction of cutting, and portability.
   d. colors, sizes, shapes, and model numbers.

2. What do air power squaring shears use as a source of power?

   a. wind power
   b. mechanical levers
   c. compressed air
   d. air operated foot lever

3. The mechanical power shear differs from the foot or air powered shear because it:

   a. is heavier built.
   b. will not stop in the middle of a cycle.
   c. does not use the "guillotine" principle.
   d. is manufactured by the Niagra Company only.

4. The foot operated squaring shear is different from air and mechanical powered because it:

   a. has no cross head.
   b. is operated with one foot only.
   c. employs the lever principle as a power source.
   d. has no back gages.

KNOWLEDGE TEST FOR ☐ ☐☐

CONTINUED duty task number PAGE 19 OF 19

DUTY | TASK | DEPT. | PROG.

Answer True or False to the items below.

1. All squaring shears have hold downs.
2. The mechanical squaring shear does not have a limiting capacity.
3. Only the foot operated shear has a cross head.
4. Different types of squaring shears use different steps in the shearing operation.
5. Metal must be square before it can be cut on a squaring shear.
6. A bad cut (incorrect dimension) can be corrected by stopping the cut and reversing the motor.
7. Waste is not important in the shearing operation because you will eventually find use for the scraps.
8. Power squaring shears are completely safe because of the blade guards.
9. The back gage guards the back of the shear shile the front gage is for finger protection.
10. Planning is not important with shears that have numerical read out on the back page.

KNOWLEDGE TEST ANSWER KEY

DUTY E
TASK 04
DEPT. IN
PROG. 9943

Multiple Choice questions

b 1.
c 2.
b 3.
c 4.
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True-False questions

[✓ T] F 1.
[✓ F] 2.
T [✓ F] 3.
T [✓ F] 4.
T [✓ F] 5.

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T [✓ F] 10.

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T F 25.

Matching questions

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STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

DUTY
TASK
PREREQ
DEPT.
PROG.
REVISED

PROGRAM: WELDING

DUTY: 2 OPERATING ARC WELDING EQUIPMENT

TASK: 0 7 Weld Single and Multiple Pass Lap Joints: True Horizontal Position

PURPOSE:

The lap joint is frequently used in welding and it is sometimes necessary to perform the weld in the horizontal position. Therefore, it is important that you attain the competency to perform this task when called upon.

DRAFT

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THE SCHOOL BOARD OF PALM BEACH COUNTY

DEPARTMENT OF VOCATIONAL-TECHNICAL EDUCATION

North Technical Education Center
7071 Garden Road
Riviera Beach, Florida 33404

South Technical Education Center
1300 S. W. 30th Avenue
Boynton Beach, Florida 33435

West Technical Education Center
2625 State Road 715
Belle Glade, Florida 33430

E. Miles Bacon, Director of Vocational-Technical Education

Wilma McCarty, Curriculum and Staff Development Specialist

THIS STUDENT LEARNING GUIDE WAS DEVELOPED BY:

Vince Repper, Welding Instructor
North Technical Education Center

Jim Schmidt, Welding Instructor
South Technical Education Center

Joe Smith, Welding Instructor
West Technical Education Center

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DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: access to equipment, tools, metal, and a work station,

YOU WILL: weld single and multiple pass lap joints: true horizontal position.

HOW WELL: You must successfully complete the Knowledge Test.

Your performance will be assessed by your instructor using the Performance Standards on page 10.

ENABLING OBJECTIVES:

1. Weld single pass lap joints in the true horizontal position.
2. Weld multiple pass lap joints in the true horizontal position.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number

PAGE 4 OF 11

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

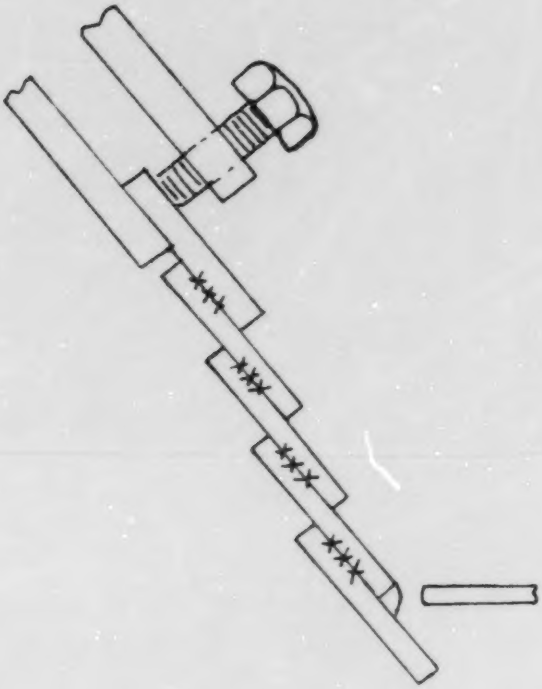
Enabling objective

Weld single pass lap joints in the true horizontal position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine how to tackweld a series of lap joints.	1. PAT Workbook - Shielded Metal Arc Welding, Topic 5, Items 1-2, page 16.
2. Tackweld lap joints by following the steps in Resource No. 1.	2. a. Work station b. Equipment c. Tools d. Material - five pieces of 3/16" x 3" x 8" mild steel plate
3. Read Resource No. 3 to determine how to position and weld single pass lap joints in the true horizontal position.	3. Instruction Sheet enclosed, Welding Single Pass Lap Joints in the True Horizontal Position
4. Weld single pass lap joints in the true horizontal position. Completely weld both sides.	4. a. Work station b. Equipment c. Tools d. Workpieces
5. Have instructor check your work.	5. Instructor
6. Evaluate your work by completing the Self-Check.	6. Self-Check enclosed.
7. Go on to Enabling Objective No. 2.	

Welding Single Pass lap Joints in the True Horizontal Position



SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 6 OF 11

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Were the weld joints completely filled, without rolling over on bottom plate?................................	___	___
2. Were the upper plates free of undercut?...............	___	___
3. Was the surface ripple uniform on all beads?..........	___	___
4. Was there approximately 3/16" leg length on bottom plate?..	___	___
5. Were all welds cleaned of slag and splatter?..........	___	___
6. Were the joints covered from end to end by welds?.....	___	___
7. Were the plates overlapped correctly?.................	___	___
8. Were all joints welded on both sides of workpiece?....	___	___

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If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 7 OF 11

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Weld multiple pass lap joints in the true horizontal position.

PROCEDURE

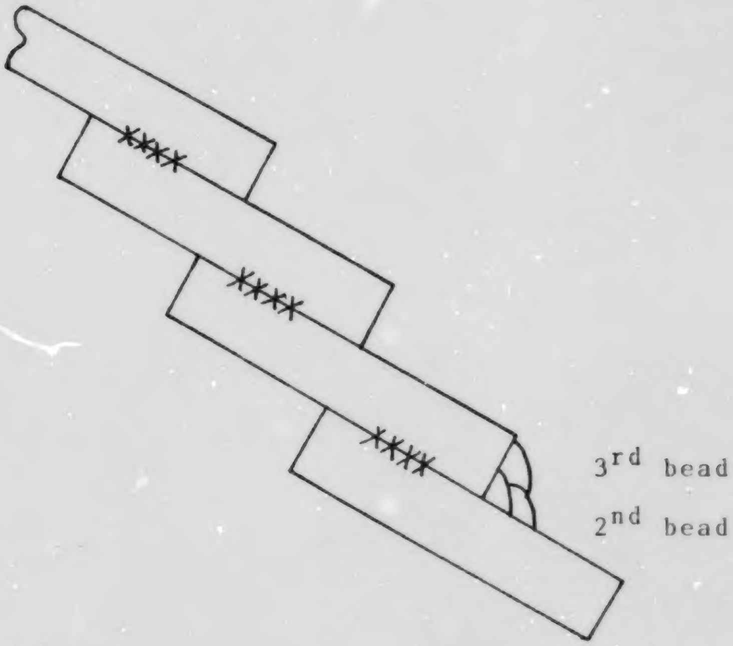
LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine how to tackweld, position, and weld multiple pass lap joints in the true horizontal position.	1. Instruction Sheet enclosed, Welding Multiple Pass Lap Joints in the True Horizontal Position
2. Tackweld, position and weld multiple pass lap joints by following the steps outlined in Resource No. 1.	2. a. Work station b. Equipment c. Tools d. Material - five pieces of 3/8" x 3" x 8" mild steel plate
3. Have instructor check your work	3. Instructor
4. Evaluate your work by completing the Self-Check.	4. Self-Check enclosed.
5. When you think you can attain this task, take the Knowledge Test.	5. Knowledge Test
6. When you successfully complete the Knowledge Test, take the Performance Test.	6. Performance Test

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 2 number PAGE 8 OF 11

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Welding Multiple Pass Lap Joints in the True Horizontal Position

1. Tackweld plates and position in weld fixture as you did in enabli Objective No. 1.
2. Follow weld bead sequence as shown in the figure below.
3. Weld all joints on both sides.



SELF-CHECK FOR ENABLING OBJECTIVE 2
number

PAGE 9 OF 11

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the item below in a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Were the weld joints full to the top edge of upper plate and slightly convex?..	___	___
2. Was there approximately 3/8" leg length on bottom plate?..	___	___
3. Were the welds free of porosity, slag inclusions and undercut?..	___	___
4. Were the joints covered from end to end by welds?.........	___	___
5. Were all joints welded on both sides of workpiece?........	___	___

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 10 OF 11

DIRECTIONS:

Given access to equipment, tools, material, and a work station, you will weld lap joints with single and multiple pass welds in the true horizontal position. You will be evaluated on attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were the plates tacked securely on both ends before starting to weld?........		
2. Were the workpieces positioned for welding horizontally?........		
3. Was the proper arc length and electrode angles used?........		
4. Were the weld beads overlapped correctly on the multiple pass welds?........		
5. Were the leg lengths approximately equal on all multiple pass welds?........		
6. Were the welds free of undercut, slag inclusion and porosity?........		
7. Were the weld joints completely full and slightly convex?........		
8. Was the surface ripple of the weld beads uniform?........		
9. Was there a minimum of weld splatter?........		
10. Were all joints welded on both sides of the workpiece?........		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

DUTY
TASK
DEPT.
PROG.

Instructional Resources

------, PAT Workbook, Hobart School of Welding Technology, Troy, Ohio, 1975.

Materials

Mild steel plate and E-6010 electrodes

KNOWLEDGE TEST FOR ☐ ☐☐
duty task number

PAGE 1 OF 2

DUTY
TASK
DEPT.
PROG.

TASK: Weld Single and Multiple Pass Lap Joints: True Horizontal Position

DIRECTIONS:

The items below are Multiple Choice. On the separate Answer sheet, put the letter of the correct answer in the blank to the left of the number of the question.

DO NOT MARK ON THIS TEST!

1. When overlapping 3" wide plates for a lap weld, the plates should overlap:

   a. approximately 1/2"..
   b. approximately 2 1/2".
   c. approximately 1 1/2".
   d. approximately 3".

2. The throat size of a fillet weld on a 3/8" plate should be at least:

   a. 1/4".
   b. 3/8".
   c. 1/2".
   d. 5/8".

3. When making the first pass (root pass) of a multiple pass fillet weld, the electrode angle is:

   a. 45° to bottom plate.
   b. 55° to bottom plate.
   c. 35° to bottom plate.
   d. 25° to bottom plate.

4. A properly deposited fillet weld is:

   a. almost as strong as the base metal.
   b. not as strong as bolting or riveting would be.
   c. stronger than the base metal.
   d. slightly concave at the face.

5. E-6010 electrodes are designed to weld with:

   a. AC.
   b. AC/DC.
   c. DCRP
   d. DCSP

KNOWLEDGE TEST FOR ☐ ☐☐

CONTINUED duty task number PAGE 2 OF 2

DUTY
TASK
DEPT.
PROG.

6. The amperage range of a 1/8" E-6010 electrode is:

   a. 250-325 amps.
   b. 75-130 amps.
   c. 90-175 amps.
   d. 140-225 amps.

7. The leg lengths of a fillet weld on 3/8" plate should be:

   a. approximately equal.
   b. longer on bottom plate.
   c. longer on top plate.
   d. so that the throat size is 1/2".

8. Excessive splatter can be caused by:

   a. amperage being too high.
   b. arc length too long.
   c. wrong polarity.
   d. all of the above.

9. A weld bead that rolls over on the edge is the result of:

   a. too high amperage and wrong electrode angle.
   b. too slow travel speed and wrong electrode angle.
   c. too fast travel speed and too low amperage.
   d. too high amperage and arc length too long.

10. The problem most frequently encountered when making a fillet weld in the true horizontal position is:

    a. undercutting the bottom plate.
    b. slag entrapment.
    c. porosity.
    d. undercutting the upper plate.

NOWLEDGE TEST ANSWER KEY

DUTY | TASK | DEPT | PROG

tiple Choice questions

___1.	b 6.	___11.	___16.	___21.
___2.	a 7.	___12.	___17.	___22.
___3.	d 8.	___13.	___18.	___23.
___4.	b 9.	___14.	___19.	___24.
___5.	d 10.	___15.	___20.	___25.

-False questions

F 1.	T F 6.	T F 11.	T F 16.	T F 21.
F 2.	T F 7.	T F 12.	T F 17.	T F 22.
F 3.	T F 8.	T F 13.	T F 18.	T F 23.
F 4.	T F 9.	T F 14.	T F 19.	T F 24.
F 5.	T F 10.	T F 15.	T F 20.	T F 25.

ching questions

___1.	___6.	___11.	___16.	___21.
___2.	___7.	___12.	___17.	___22.
___3.	___8.	___13.	___18.	___23.
___4.	___9.	___14.	___19.	___24.
___5.	___10.	___15.	___20.	___25.

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 2 OPERATING ARC WELDING EQUIPMENT

TASK: 0 5 Weld Outside Corner Joints: Flat position

PURPOSE:

The outside corner joint is widely used in the fabrication of tanks, containers and other structural forms. It is important that you attain competency in this task to be able to make this type of weld on the job.

DRAFT

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DUTY
TASK
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OBJECTIVES

DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:
(Include condition, performance,
and standard)

GIVEN: access to equipment, tools, metal and a work station,

YOU WILL: tackweld and weld a series of multiple pass outside corner joints in the flat position.

HOW WELL: You must successfully complete the Knowledge Test.

Your performance will be assessed by your instructor using the Performance Test on page 11.

ENABLING OBJECTIVES:

1. Set-up the work station.
2. Tackweld and weld multiple pass outside corner joints in the flat position.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number

PAGE 4 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Set-up work station.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine how to set-up the work station for tackwelding and welding multiple pass outside corner joints in the flat position.	1. Instruction Sheet enclosed, Setting Up the Work Station
2. Set-up the work station.	2. a. Welding table b. Welding machine c. Ground clamp d. Metal plates
3. Have instructor check your work station.	3. Instructor
4. Go on to Enabling Objective No. 2.	

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 1 number PAGE 5 OF 12

DUTY TASK EN. OBJ. DEPT. PROG.

Setting Up the Work Station

1. Clean off top of welding table and attach ground clamp securely.
2. Set welding machine for polarity and amperage required for 1/8" E-6010 electrodes and steel plate.
3. Place three plates on table as shown in Figure 1 below.

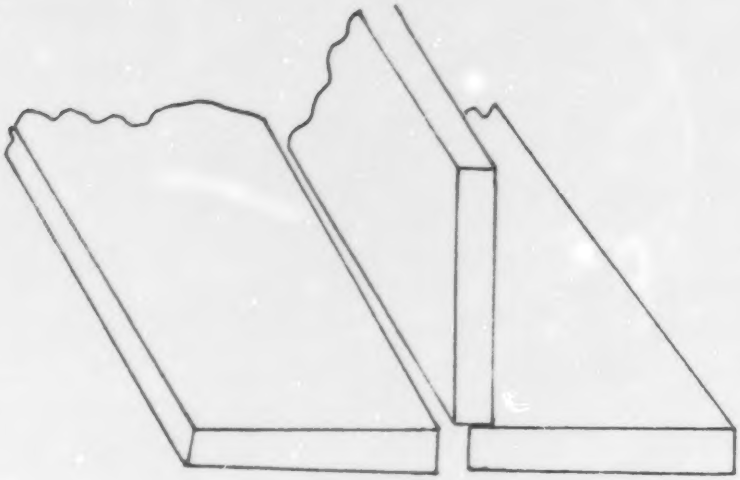

Figure 1

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 6 OF 12

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Enabling objective

Tackweld and weld multiple pass outdide corner joints in the flat position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify how to tackweld outside corner joints.	1. Instruction Sheet enclosed, Tackwelding Outside Corner Joints
2. Tackweld outside corner joints by following instructions outlined in Resource No. 1.	2. a. Work station b. Equipment c. Tools d. Material - four pieces of 1/2" x 2" x 8" mild steel plate
3. Have instructor check your work.	3. Instructor
4. Read Resource No. 4 to determine how to weld outside corner joints in the flat position.	4. Instruction Sheet enclosed, Welding Outside Corner Joints
5. Weld the outside corner joints by following instructions outlined in Resource No. 4.	5. a. Work station b. Equipment c. Tools d. Material
6. Have instructor check your work.	6. Instructor
7. Evaluate your work by completing the Self-Check.	7. Self-Check enclosed.
8. When you think you can attain this task, take the Knowledge Test.	8. Knowledge Test for task .
9. When you successfully complete the Knowledge Test, take the Performance Test.	9. Performance Test for task

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Tackwelding Outside Corner Joints

CAUTION: BE SURE TO LEAVE 1/16" SPACE (ROOT OPENING) TO ALLOW COMPLETE PENETRATION.

1. Tackweld approximately 1/2" in from both ends. Make tackwelds on inside of angle as shown by XXXX in Figure 1 below.
2. Set-up and tackweld two remaining plates.
3. Place the two outside corner joints as shown in Figure 2 below and tackweld as in Step No. 1.

NOTE: This will make three outside corner joints.

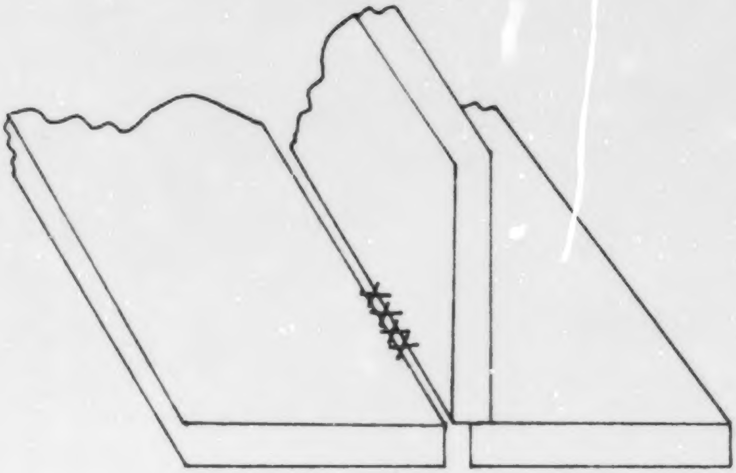

Figure 1

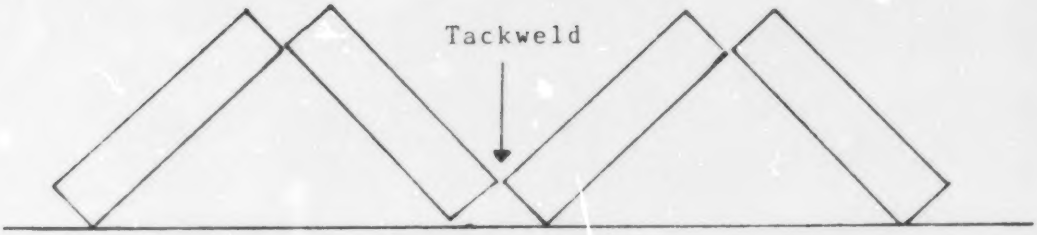

Figure 2

Welding Outside Corner Joints

1. To make the first (root) pass:

   a. hold the electrode 45° to the weld joint.

   b. lean the electrode 10° to 15° in the direction of travel (lead angle).

   c. strike arc approximately ½" from left edge of workpiece, quickly move electrode to left edge and establish the proper arc length (1/8").

   d. use a "whipping" motion to continue the bead to the right edge of the workpiece.

   Note: You should have a small hole (keyhole) just in front of the weld puddle. This is necessary to attain complete penetration (100°).

   e. break arc and fill crater.

   f. remove all slag using the chipping hammer and wire brush.

2. To make the second pass:

   a. hold the electrode 55° to the side of the weld joint nearest you and with a 10° lead angle.

   b. strike arc approximately ½" from left edge, quickly move electrode to left edge and establish proper arc length.

   c. be sure you are melting and fusing into both the first weld bead and the edge of the weld joint.

   d. complete the second pass, fill crater and remove slag.

3. To make the third pass:

   a. hold the electrode 35° to the side of the weld joint nearest you and with a 10° to 15° lead angle.

   b. strike the arc and deposit the weld bead as you did the first two passes. Make sure you melt and fuse into both the first and second beads and the edge of the weld joint.

   c. complete the third pass, fill crater and remove slag.

4. It will be necessary to deposit a second layer of weld beads (perhaps a third) to completely fill the weld joint.

Note: The first pass of the second and succeeding layers will be made on the side of the weld joint nearest you. The second layer will require three weld beads; the third layer, four beads.

[illegible]. Continue depositing layers of weld beads until weld joint is full and rounded. See note on following page.

Note: The throat size (distance from face of weld to the root) must be at least as thick as the metal being welded.

[illegible]. Weld other two outside corner joints using the same procedure.

SELF-CHECK FOR ENABLING OBJECTIVE 2 number PAGE 10 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.
All items should receive a "YES" response.

	YES	NO
1. Was there 100% penetration on all finished welds?	___	___
2. Were weld joints full from end to end?	___	___
3. Were the throat sizes at least as thick as the base metal?	___	___
4. Was all slag removed?	___	___
5. Were the welds free of porosity?	___	___
6. Was the surface ripple uniform on all beads?	___	___
7. Was there a minimum of undercut?	___	___

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 11 OF 12

DIRECTIONS:

Given access to equipment, tools, metal, and a work station, you will make all setups and weld a series of multiple pass outside corner joints in the flat position. You will be evaluated on attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Was there 100% penetration on all welds?		
2. Were the weld joints full from end to end?		
3. Was the surface ripple of the weld beads uniform?		
4. Were the throat sizes at least as thick as the base metal?		
5. Were all weld beads fused with the adjoining metal?		
6. Was all of the slag removed?		
7. Were the welds free of porosity?		
8. Was there a minimum of undercut in the welds?		
9. Were all craters filled?		
10. Were the weld beads deposited in the proper sequence?		
11. Were all weld joints welded?		
12. Was the work station secured?		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained
☐ Not attained

EVALUATOR

DEPT.

PROG.

LIST OF RESOURCES, MATERIALS, AND EQUIPMENT

PAGE 12 OF 12

DUTY

TASK

DEPT.

PROG.

No additional resources required.

KNOWLEDGE TEST FOR ☐ ☐☐

duty task number

PAGE 1 OF 1

DUTY

TASK

DEPT.

PROG.

TASK: Weld Outside Corner Joints: Flat Position

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet, circle Ⓣ if the item is True and Ⓕ if the item is False.

DO NOT MARK ON THIS TEST!

1. Straight polarity is used for E-6010 electrodes.
2. When welding ½" thick metal, the throat size must be at least ½".
3. To obtain 100% penetration, you must carry a keyhole when making the root pass.
4. It is not necessary to remove the slag before making another pass.
5. To make a second layer of weld beads, you position the first bead on the side of the joint opposite you.
6. Proper arc length is equal to the electrode diameter or less.
7. Each weld bead must melt and fuse into the adjoining metal.
8. The outside corner joint is not widely used.

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

DUTY 2
TASK 10
PREREQ.
DEPT. IN
PROG. 9943
REVISED

PROGRAM: WELDING

DUTY: 2 OPERATING SHIELDED METAL ARC WELDING EQUIPMENT

TASK: 1 0 Weld Butt Joints: Horizontal Position

PURPOSE:

DRAFT

The butt weld is a common weld joint used in most welded fabrications. You must be able to perform this weld in the horizontal position where it is necessary for the job to be completed.

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OBJECTIVES

PAGE 3 OF 8

DUTY 2
TASK 10
DEPT. IN
PROG. 9943

PERFORMANCE OBJECTIVE:
(Include condition, performance,
and standard)

GIVEN: access to equipment, tools, metal, and a work station,

YOU WILL: weld butt joints: horizontal position.

HOW WELL: Your performance will be assessed by your instructor using the Performance Test on page 7.

ENABLING OBJECTIVES:

1. Tackweld a series of butt welds.
2. Weld a series of butt welds.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number

PAGE 4 OF 8

DUTY 2
TASK 10
EN. OBJ. 1
DEPT. IN
PROG. 9943

Enabling objective

Tackweld a series of butt welds.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify steps in tackwelding butt joints.	1. a. *PAT Workbook* - Topic 11, page 27. b. Beseler Cue/See; Topic 11
2. Tackweld butt joints by following the steps in Resource No. 1.	1. a. Work station b. Equipment c. Tools d. Material - five pieces of 3/16" x 2" x 8" steel plate
3. Have your instructor check your work.	3. Instructor
4. Go on to Enabling Objective No. 2.	

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number PAGE 5 OF 8

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Weld a series of butt welds.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify how to position and weld butt joints.	1. a. PAT Workbook - Topic 11, pages 28-29. b. Beseler Cue/See; Topic 11
2. Position and weld butt joints by following the steps in Resource No. 1.	2. a. Work station b. Equipment c. Tools d. Materials
3. Evaluate your work by completing the Self-Check.	3. Self-Check enclosed.
4. Have instructor check your work.	4. Instructor
5. When you think you can perform this task, take the Performance Test.	5. Performance Test for task 2-10.

SELF-CKECK FOR ENABLING OBJECTIVE 2 number

PAGE 6 OF 8

DUTY 2 | TASK 10 | EN. OBJ. 2 | DEPT. IN | PROG. 9943

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Was there 100% penetration on all welds?.................	___	___
2. Was all of the undercut left by the first pass completely covered by the cover pass?..............................	___	___
3. Was the weld joint full from end to end?.................	___	___
4. Was the surface ripple of the weld beads uniform?........	___	___
5. Was all of the slag removed?.............................	___	___

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR 2 | 1 0

duty task number

PAGE 7 OF 8

DIRECTIONS:

Given access to equipment, tools, metal and a work station, you will tackweld and weld a series of butt joints in the horizontal position. You will be evaluated on attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were the plates tackwelded according to instructions?		
2. Was there 100% penetration on all welds?		
3. Was all undercut completely covered by the cover passes?		
4. Were the cover passes convex and slightly higher than the plate surfaces?		
5. Were the welds free of porosity?		
6. Was all slag removed?		
7. Were the weld joints full from end to end?		
8. Was the surface ripple of the beads uniform?		
9. Was the proper arc length and electrode angle used?		
10. Was the work station secured?		

DUTY 2
TASK 10
ATTEMPT
STUDENT
DATE
☐ Attained
☐ Not attained
EVALUATOR
DEPT. IN
PROG. 9943

LIST OF RESOURCES, MATERIALS, AND EQUIPMENT

PAGE 8 OF 8

DUTY 2
TASK 10
DEPT. IN
PROG. 9943

Instructional Resources

Texts

-----, PAT Workbook, Hobart School of Welding Technology, Troy, Ohio. 1975.

Audiovisual

Beseler Cue/See Filmstrip System, Charles Beseler Company, Florham Park, New Jersey, 1977.

Materials

Mild steel plate

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 2 OPERATING ARC WELDING EQUIPMENT

TASK: 0 8 Weld Multiple Pass Tee Joints: True Horizontal Position

PURPOSE:

The tee joint (inside corner) is the most common type of weld that the welder will encounter. It is most important that you acquire the manipulating skill necessary to make this type of weld in the horizontal position.

DRAFT

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY
TASK
PREREQ
DEPT.
PROG.
REVISED

PERFORMANCE OBJECTIVE:
(Include condition, performance,
and standard)

GIVEN: access to equipment, metal, electrodes, and work station,

YOU WILL: weld multiple pass tee joints: true horizontal position.

HOW WELL: You must successfully complete the Knowledge Test.

Your performance will be assessed by your instructor using the Performance Test on page 11.

ENABLING OBJECTIVES:

1. Set-up work station, tackweld, and weld 3-pass tee joints in the horizontal position.
2. Tackweld and weld 6-pass tee joints in the horizontal position.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number

PAGE 4 OF 12

Enabling objective

Set-up work station, tackweld, and weld 3-pass tee joints in the horizontal position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify the steps in setting up a work station and tackwelding tee joints.	1. a. Instruction Sheet enclosed, Setting Up a Work Station and Tackwelding Tee Joints b. Work station c. Materials - 2 pieces of 1/4" x 3" x 8" mild steel plate and 2 pieces of 1/4" x 1½" x 8" mild steel plate
2. Read Resource No. 2 to identify the steps in positioning the tee joint and the bead sequence when welding.	2. Instruction Sheet enclosed, Positioning and Welding Sequence for 3-Pass Tee Joints
3. Make 3-pass welds on both sides of both tee joints by following the procedure outlined in Resource No. 2. Have your instructor check your work.	3. a. Work station b. Tools c. Materials
4. Evaluate your work by completing the Self-Check.	4. Self-Check enclosed.
5. Go on to Enabling Objective No. 2.	

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 1 number PAGE 5 OF 12

DUTY

TASK

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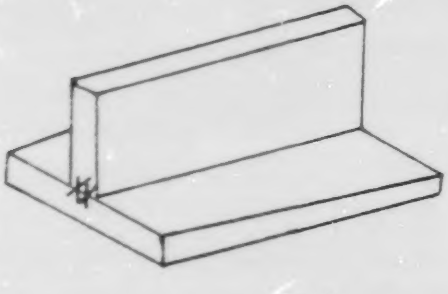
Setting Up a Work Station and Tackwelding Tee Joints

1. Be sure electrode holder, ground clamp, and cables are in a safe, usuable condition.
2. Attach ground clamp and set welding machine for proper polarity and amperage for 1/8" E-6010 electrodes.
3. Place one piece 1/4" x 3" x 8" plate flat on table.
4. Place one piece 1/4" x 1½" x 8" plate on edge in approximate center of 3" wide piece to form a "T".
5. Securely tackweld both ends of "T" joint as shown below.
6. Tackweld second tee joint using the same procedure.

Figure 1



Positioning and Welding Sequence for 3-Pass Tee Joints

1. Clamp workpiece in welding fixture at an approximate 45° angle. You should be looking straight into the Vee formed by the weld joint.
2. Deposit the root pass. See Figure 1 below.
3. Turn workpiece around in fixture so that you are looking at the other side of the weld joint.
4. Deposit all three weld beads. See Figure 2 below.
5. Turn workpiece around in fixture and finish welding the other side of the weld joint.
6. Weld second tee joint in same sequence.

NOTE: This welding sequence will help to control distortion of the workpiece.

Figure 1

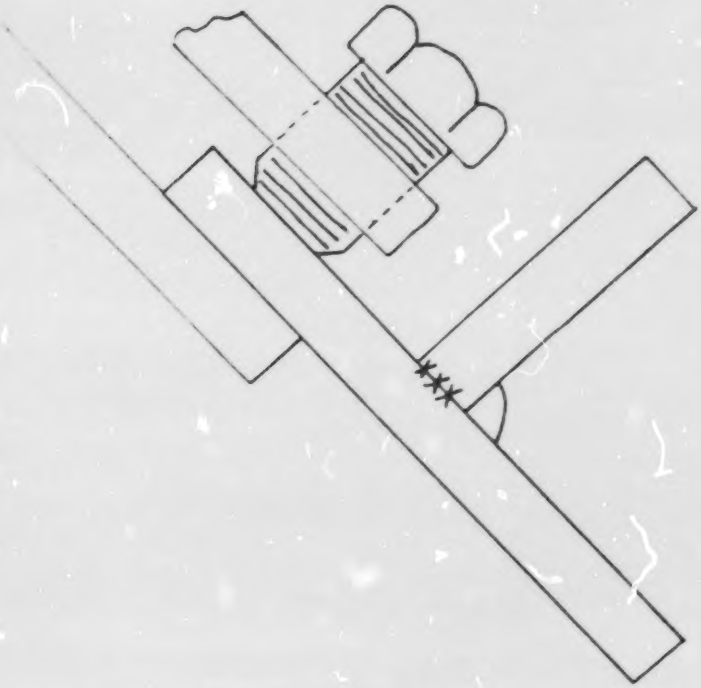
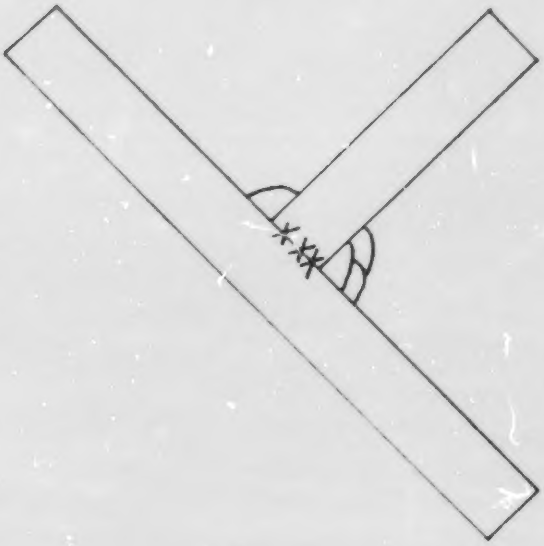


Figure 2



SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 7 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Was there a minimum of distortion in the workpiece?....	___	___
2. Were the leg lengths of the welds approximatley equal?.	___	___
3. Were the weld beads overlapped without rolling over?...	___	___
4. Were welds full from end to end of the workpiece?......	___	___
5. Were welds free of undercut?...........................	___	___
6. Was weld splatter removed from workpiece?..............	___	___
7. Was uniform surface ripple maintained?.................	___	___

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2

number

PAGE 8 OF 12

DUTY

TASK

EN. OBJ.

DEPT

PROG.

Enabling objective

Tackweld and weld 6-pass tee joints in the horizontal position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify the steps in positioning and welding bead sequence for 6-pass tee joints.	1. Instruction Sheet enclosed, Positioning and Welding Bead Sequence for 6-Pass Tee Joints
2. Make 6-pass tee joints by following the procedure outlined in Resource No. 1. Have your instructor check your work.	2. a. Work station b. Tools c. Materials - 2 pieces of 1/4" x 3" x 8" mild steel plate and 2 pieces of 1/4" x 1½" x 8" mild steel plate
3. Evaluate your work by completing the Self-Check.	3. Self-Check enclosed.
4. When you think you can attain this task, take the Knowledge Test.	4. Knowledge Test
5. When you successfully complete the Knowledge Test, take the Performance Test.	5. Performance Test

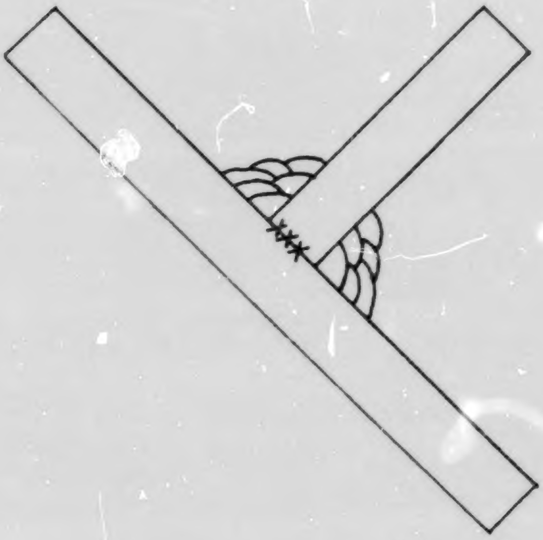
INSTRUCTION SHEET FOR ENABLING OBJECTIVE 2 number PAGE 9 OF 12

DUTY
TASK
EN. OBJ
DEPT
PROG

Positioning and Welding Bead Sequence for 6-Pass Tee Joints

1. Tackweld tee joints.
2. Clamp in weld fixture and deposit first three beads as you did for the three pass tee joints.
3. Starting on bottom plate, deposit three more weld beads on each side of weld joint. See Figure 1 below.
4. Weld second tee joint the same way.

Figure 1



SELF-CHECK FOR ENABLING OBJECTIVE 2 number PAGE 10 OF 12

DUTY

TASK

EN. OBJ

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Was there a minimum of distortion in the workpeice?......	___	___
2. Were leg lengths of welds approximately equal?..........	___	___
3. Were beads overlapped without rolling over?.............	___	___
4. Were welds full from end to end of the workpiece?........	___	___
5. Were welds free of undercut?............................	___	___
6. Was weld splatter removed from workpiece?...............	___	___
7. Was uniform surface ripple maintained?..................	___	___

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ ☐☐
duty task number

PAGE 11 OF 12

DIRECTIONS.

Given access to equipment, metal, electrodes, and work station, you will weld multiple pass tee joints: true horizontal position. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Was distortion held to a minimum?		
2. Were the welds free of undercut and porosity?		
3. Were the weld beads overlapped without roll over?		
4. Were the leg lengths approximately equal for all three pass welds?		
5. Were the leg lengths approximately equal for all six pass welds?		
6. Were the joints welded from end to end?		
7. Was the surface ripple of all beads uniform?		
8. Were the workpieces tackwelded on both ends?		
9. Was the throat size of the six pass welds at least as thick as the base metal?		
10. Were the workpieces cleaned of all slag and splatter?		

DUTY
TASK
ATTEMPT
STUDENT
DATE
☐ Attained
☐ Not attained
EVALUATOR
DEPT.
PROG.

LIST OF RESOURCES, MATERIALS, AND EQUIPMENT

PAGE 12 OF 12

DUTY
TASK
DEPT.
PROG.

No additonal resources required.

KNOWLEDGE TEST FOR ☐ ☐☐

duty task number

PAGE 1 OF 1

DUTY

TASK

DEPT.

PROG.

TASK Weld Multiple Paas Tee joints: True Horizontal Position

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet, circle Ⓣ if the item is True and Ⓕ if the item is False.

DO NOT MARK ON THIS TEST!

1. Undercutting the upper plate is a major problem when welding a tee joint.
2. The third and sixth passes of a six pass tee weld should be made against the bottom plate.
3. Striking the arc in from the edge of the weld joint and quickly moving to the edge to start the weld helps to prevent slag entrapment.
4. Weld bead sequence has little to do with distortion.
5. Leg lengths are not important when welding plates of equal thickness..
6. Undercut means an area that has melted out and not been filled on the base metal.
7. The throat size should be at least as thick as the thinnest member of the metal base.
8. The root pass is made with the electrode held 45° to the weld joint.
9. An excess of weld splatter and a wide flat bead indicates your arc length is too long.
10. Undercutting is less of a problem when making tee joints in the horizontal position that in the flat position.

KNOWLEDGE TEST ANSWER KEY

Multiple choice questions

___1. ____6. ____11. ____16. ____21.

___2. ____7. ____12. ____17. ____22.

___3. ____8. ____13. ____18. ____23.

___4. ____9. ____14. ____19. ____24.

___5. ____10. ____15. ____20. ____25.

True-False questions

[✓ T] F 1. [✓ T] F 6. T F 11. T F 16. T F 21.

[✓ T] 2. [✓ T] F 7. T F 12. T F 17. T F 22.

[✓ T] F 3. [✓ T] F 8. T F 13. T F 18. T F 23.

[✓ T] 4. [✓ T] F 9. T F 14. T F 19. T F 24.

[✓ T] 5. T [✓ F] 10. T F 15. T F 20. T F 25.

[illegible] questions

___1. ____6. ____11. ____16. ____21.

___2. ____7. ____12. ____17. ____22.

___3. ____8. ____13. ____18. ____23.

___4. ____9. ____14. ____19. ____24.

___5. ____10. ____15. ____20. ____25.

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STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 2 OPERATING ARC WELDING EQUIPMENT

TASK: 0 9 Weld Outside Corner Joints: Horizontal Position

PURPOSE:

The outside corner joint is widely used in the fabrication of tanks, containers, and various structural forms. It is important that you attain competency in this task to be able to make this type of weld in the horizontal position.

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DUTY 2
TASK 09
PREREQ
DEPT IN
PROG. 9943
REVISED

OBJECTIVES

PAGE 3 OF 10

DUTY	2
TASK	09
DEPT.	IN
PROG.	9943

PERFORMANCE OBJECTIVE:
(Include condition, performance,
and standard)

GIVEN: access to equipment, metal, electrodes, and a work station,

YOU WILL: weld outside corner joints: horizontal position.

HOW WELL: You must successfully complete the Knowledge Test.

Your performance will be assessed by your instructor using the Performance Test on page 9.

ENABLING OBJECTIVES:

1. Prepare to weld outside corner joints in the horizontal position.
2. Tackweld and weld outside corner joints in the horizontal position.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1

number

PAGE 4 OF 10

DUTY 2
TASK 09
EN OBJ. 1
DEPT. IN
PROG. 9943

Enabling objective

Prepare to weld outside corner joints in the horizontal position.

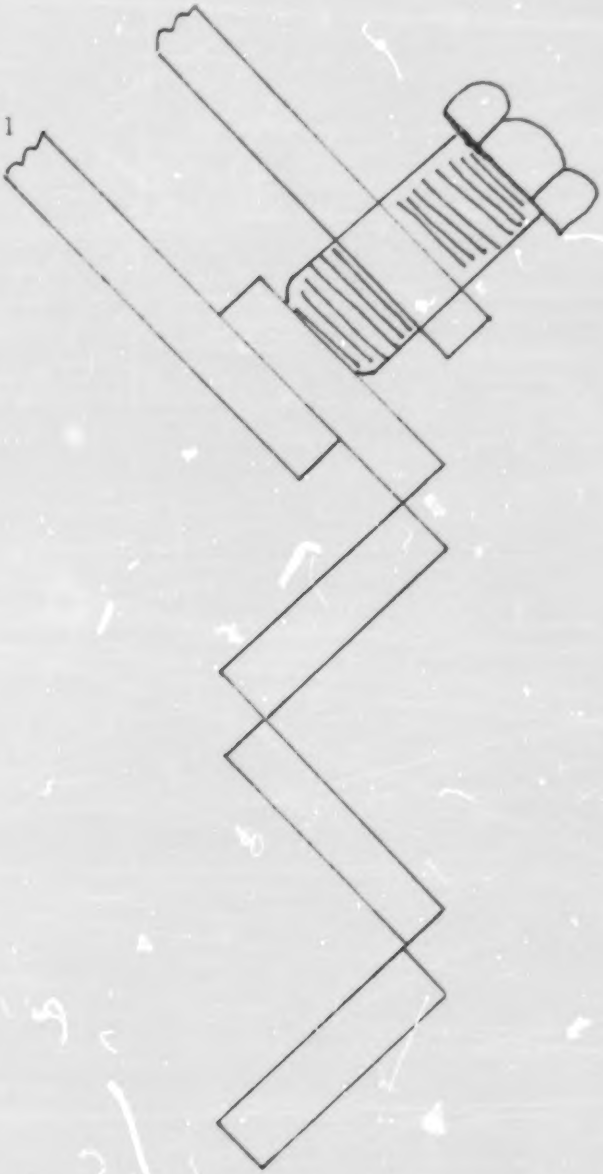
PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine positioning and welding sequence for outside corner joints.	1. Instruction Sheet enclosed, Positioning and Welding Outside Corner Joints
2. See instructor for oral questioning.	2. Instructor
3. When you think you can attain this task, take the Knowledge Test.	3. Knowledge Test
4. Go on to Enabling Objective No. 2.	

Positioning and Welding Outside Corner Joints

1. Position the workpiece in the welding fixture as shown in Figure 1.

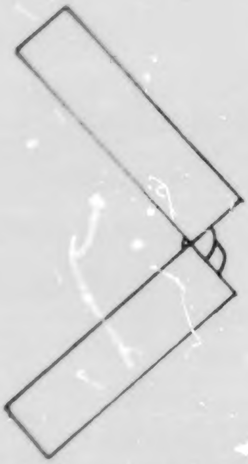
Figure 1



2. Deposit the root pass. You should have 100% penetration.

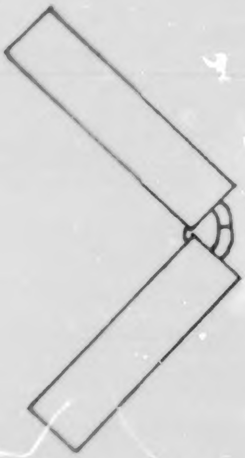
3. Deposit the second pass near the lower edge of the weld joint. Be sure to overlap more than half of the root pass. See Figure 2 on the following page.

Figure 2



4. Deposit the third pass by overlapping the second pass and fusing with upper section of weld joint. See Figure 3 below.

Figure 3



5. Additional layers of weld beads may be necessary to make sure the weld joint is full and slightly rounded. Deposit these beads from bottom to top of weld joint.
6. Weld other two outside corner joints using the same procedure.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2

number

PAGE 7 OF 10

DUTY 2
TASK 09
EN. OBJ. 2
DEPT. IN
PROG. 9943

Enabling objective

Tackweld and weld outside corner joints in the horizontal position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Tackweld plates to form three outside corner joints. Have your instructor check your work.	1. a. Work station b. Equipment c. Material - 4 pieces of 3/8" or 1/2" x 2" x 8" mild steel plate
2. Weld outside corner joints. Have your instructor check your work.	2. Same as above.
3. Evaluate your work by completing the Self-Check.	3. Self-Check enclosed.
4. When you think you can perform this task, take the Performance Test.	4. Performance Test

SELF-CHECK FOR ENABLING OBJECTIVE 2 number

PAGE 8 OF 10

DUTY 2 | TASK 09 | EN. OBJ. 2 | DEPT. IN | PROG. 9943

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should reveive a "YES" response.

	YES	NO
1. Was there 100% penetration on all finished welds?.......	___	___
2. Were throat sizes at least as thick as the base metal?..	___	___
3. Were welds free of porosity and slag inclusions?........	___	___
4. Was surface ripple uniform on all beads?................	___	___
5. Were weld joints full from end to end?..................	___	___

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 9 OF 10

DIRECTIONS:

Given access to equipment, metal, electrodes, and work station, you will weld outside corner joints in the horizontal position. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Was there 100% penetration on all finished welds?........................		
2. Were welds full and rounded?...		
3. Were beads deposited in the proper sequence?..............................		
4. Was surface ripple of weld beads uniform?.................................		
5. Were welds free of porosity and slag inclusions?..........................		
6. Were beads overlapped without rolling over?...............................		
7. Was bead at bottom edge of joint deposited without sagging?...............		
8. Was there a minimum of undercut?..		
9. Were throat sizes at least as thick as the base metal?....................		
10. Were all joints welded?..		

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DUTY 2
TASK 09
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☐ Attained
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EVALUATOR
DEPT. 1N
PROG. 9943

LIST OF RESOURCES, MATERIALS, AND EQUIPMENT PAGE 10 OF 10

DUTY	2	TASK	09	DEPT.	IN	PROG.	9943

No additional resources required.

KNOWLEDGE TEST FOR ☐ ☐☐
duty task number

PAGE 1 OF 1

DUTY 2 | TASK 09 | DEPT. IN | PROG. 9943

TASK: Weld Outside Corner Joints: Horizontal osition

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet, circle Ⓣ if the item is True and Ⓕ if the item is False.

1. The amperage range for any electrode is to allow for different thicknesses of the metal to be welded.
2. When welding 1/2" thick metal the throat size must be at least 3/8".
3. In order to obtain the correct throat size on an outside corner weld, the weld must be full and rounded.
4. To obtain 100% penetration you must have a space at the root of the joint or carry a keyhole or both.
5. Too long an arc length will cause excess splatter and undercutting.
6. To avoid sag at the bottom edge of the weld, your travel speed must be faster.
7. It is not necessary to adjust the amperage once you have started welding an outside corner.
8. The outside corner joint in not widely used.
9. If you are in a hurry it is not necessary to remove the slag before making another pass.
10. Each weld bead must melt and fuse into the adjoining metal.

NOWLEDGE TEST ANSWER KEY

DUTY
TASK
DEPT
PAGE

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ue-False questions

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PLEASE NOTE:

Continued emphasis will be placed upon the following programs for the 1983-84 school year: Carpentry, Welding, Diesel Engine Mechanics, Heavy Equipment and Operation, Heavy Equipment Mechanics, Automotive Body Repair and Refinishing, Parts Marketing and Commercial Foods and Culinary Arts.

VTAD grants for audiovisual materials have been submitted for Carpentry and Welding. These programs will require classroom reorganization. Audiovisual software and hardware are key components in developing a CBI system. Therefore, the process of acquiring audiovisual materials and developing student learning guides go hand in hand!!

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM:	WELDING
DUTY: 2	OPERATING ARC WELDING EQUIPMENT
TASK: 1 1	Weld Single and Multiple Pass Lap Joints: Vertical Position

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PURPOSE:

Welding in the vertical position is a difficult operation. Many jobs which cannot be moved require making vertical welds. Therefore, the welder needs to become competent in making vertical welds.

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DUTY 2
TASK 11
PREREQ.
DEPT. IN
PROG. 9943
REVISED

OBJECTIVES PAGE 3 OF 8

DUTY 2
TASK 11
DEPT. IN
PROG. 9943

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: access to equipment, tools, metal, and a work station,

YOU WILL: weld single and multiple pass lap joints: vertical position.

HOW WELL: You must successfully complete the Knowledge Test.

Your performance will be assessed by your instructor using the Performance Test of page 7.

ENABLING OBJECTIVES:

1. Weld single pass lap joints in the vertical position.
2. Weld multiple pass lap joints in the vertical position.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number

PAGE 4 OF 8

DUTY 2 | TASK 11 | EN. OBJ. 1 | DEPT. IN | PROG. 9943

Enabling objective:

Weld single pass lap joints in the vertical position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to determine how to position and weld single pass lap joints in the vertical position.	1. a. PAT Workbook - Topic 13, Items 1-3, pages 32-33. b. Beseler Cue/See; Topic 13
2. Tackweld and position steel plates by following the steps in Resource No. 1.	2. a. Work station b. Equipment c. Tools d. material - five pieces of 3/16" x 3" x 8" steel plate
3. Weld single pass lap joints in the vertical position.	3. Same as resource No. 2 above.
4. Have instructor check your work.	4. Instructor
5. Evaluate your work by completing the Self-Check.	5. Self-Check enclosed.
6. Go on to Enabling Objective No. 2.	

SELF-CKECK FOR ENABLING OBJECTIVE 1 number PAGE 5 OF 8

DUTY 2 | TASK 11 | EN. OBJ. 1 | DEPT. IN | PROG. 9943

DIRECTIONS:

Evaluate your work by answering the items below. All items should receive a "YES" response.

	YES	NO
1. Were the welds free of undercut?......................	___	___
2. Were the weld joints filled completely and slightly convex?..	___	___
3. Was the surface ripple of the weld beads uniform?.....	___	___
4. Was all slag and weld splatter removed?...............	___	___
5. Were the joints covered by the weld from edge to edge?...	___	___
6. Were the welds free of porosity and slag entrapment?..	___	___
7. Were all joints welded?...............................	___	___

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 6 OF 8

DUTY 2
TASK 11
EN. OBJ. 2
DEPT. IN
PROG. 9943

Enabling objective:

Weld multiple pass lap joints in the vertical position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to determine how to position and weld multiple pass lap joints in the vertical position.	1. a. PAT Workbook - Topic 15, Items 1-3, pages 37-39. b. Beseler Cue/See; Topic 15
2. Tackweld and position steel plates by following the steps in Resource No. 1.	2. a. Work station b. Equipment c. Tools d. Material - five pieces 1/2" x 3" x 8" steel plate
3. Weld multiple pass lap joints in the vertical position.	3. Same as Resource No. 2 above.
4. Have instructor check your work.	4. Instructor
5. When you think you can attain this task, take the Knowledge Test.	5. Knowledge Test for task 2-11.
6. When you successfully complete the Knowledge Test, take the Performance Test.	6. Performance Test for task 2-11.

ERFORMANCE TEST FOR 2 | 1 | 1
duty task number

PAGE 7 OF 8

IRECTIONS:

Given access to equipment, tools, metal plates, electrodes and a work station, you will weld single and multiple pass lap joints in the vertical position. You will be evaluated on attainment of this task, based upon the items listed below.

ERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were the plates overlapped approximately 1/2 the width when tackwelded?		
2. Were the plates tackwelded securely on both ends?		
3. Were the weld joints full from edge to edge?		
4. Were the throat sizes equal to the thickness of the base metal?		
5. Were the weld joints full without sagging back?		
6. Was the surface ripple of all beads uniform and approximately 1/16" to 3/32" apart?		
7. Were the welds free of undercut?		
8. Was all slag and weld splatter removed?		
9. Were the leg lengths approximately equal?		
10. Were all joints welded?		

DUTY 2
TASK 11
ATTEMPT
STUDENT
DATE
☐ Attained
☐ Not attained
EVALUATOR
DEPT. IN
PROG. 9943

LIST OF RESOURCES, MATERIALS, AND EQUIPMENT

PAGE 8 OF 8

DUTY 2
TASK 11
DEPT. IN
PROG. 9943

Instructional Resources

Texts

------, PAT Workbook, Hobart School of Welding Technology, Troy Ohio, 1975.

Audiovisual

Beseler Cue/See Filmstrip System, Charles Beseler Company, Florham Park, New Jersey, 1977.

Materials

Mild steel plate and E-6010 electrodes

KNOWLEDGE TEST FOR 2 (duty) 1 1 (task number)

PAGE 1 OF 1

DUTY 2 | TASK 11 | DEPT. IN | PROG. 9943

TASK: Weld Single and Multiple Pass Lap Joints: Vertical Position

DIRECTIONS: The items below are True-False. On the separate Answer Sheet, circle Ⓣ if the item is True and Ⓕ if the item is False.

DO NOT MARK ON THIS TEST!

1. The electrode should be angled (pointed) upward approximately 45° when making a vertical lap weld.
2. If you increase the electrode angle as you travel upward, the weld will become narrow and high crowned.
3. An inverted "T" motion will help you deposit a wider and flatter bead.
4. The surface ripples of the weld beads should be 1/8" to 3/16" apart.
5. When making the second and third weave beads, you should pause at the toe lines of the previous beads to prevent undercut.
6. You need to hold a longer arc length when making a vertical lap weld.
7. If the weld puddle gets too hot or too large, the weld will sag down in the center.
8. Slag entrapment in the center of the weld beads is caused by not coming back into the puddle close enough.
9. The whip and pause motion should not be used when welding vertically.
10. Vertical position welding is not used very often.

OWLEDGE TEST ANSWER KEY

DUTY

TASK

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PROG.

tiple Choice questions

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STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 2 OPERATING ARC WELDING EQUIPMENT

TASK: 1 2 Weld Multiple Pass Tee Joints: Vertical Position

PURPOSE:

The tee joint is one of the most common joints encountered in welding. Therefore, it is necessary the welder attain the skills needed to perform this weld in the vertical position.

DRAFT

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY
TASK
PREREQ
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REVISED

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: access to equipment, metal, electrodes, and work station,

YOU WILL: weld multiple pass tee joints: vertical position.

HOW WELL: You must successfully complete the Knowledge Test.

Your performance will be assessed by your instructor using the Performance Test on page 9.

ENABLING OBJECTIVES:

1. Weld 3-pass tee joints: vertical position.
2. Weld 6-pass tee joints: vertical position.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number PAGE 4 OF 10

Enabling objective:

Weld 3-pass tee joints: vertical position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the steps in positioning and welding 3-pass tee joints: vertical position.	1. a. PAT Workbook, Topic 15, Items 1-3, pages 37-39. b. Beseler Cue/See, Topic 15, c. Instruction Sheet enclosed, Positioning and Tacking Plates
2. Tackweld and position plates by following the procedure outlined in Resource No. 1.	2. a. Work station b. Tools c. Materials - 1 piece of 1/4" x 4" x 8" mild steel plate and 2 peices of 1/4" x 2" x 8" mild steel plate
3. Weld 3-pass tee joints: vertical position. Have your instructor check your work.	3. a. Work station b. Tools
4. Evaluate your work by completing the Self-Check.	4. Self-Check enclosed.
5. Go on to Enabling Objective No. 2.	

DUTY

TASK

EN. OBJ.

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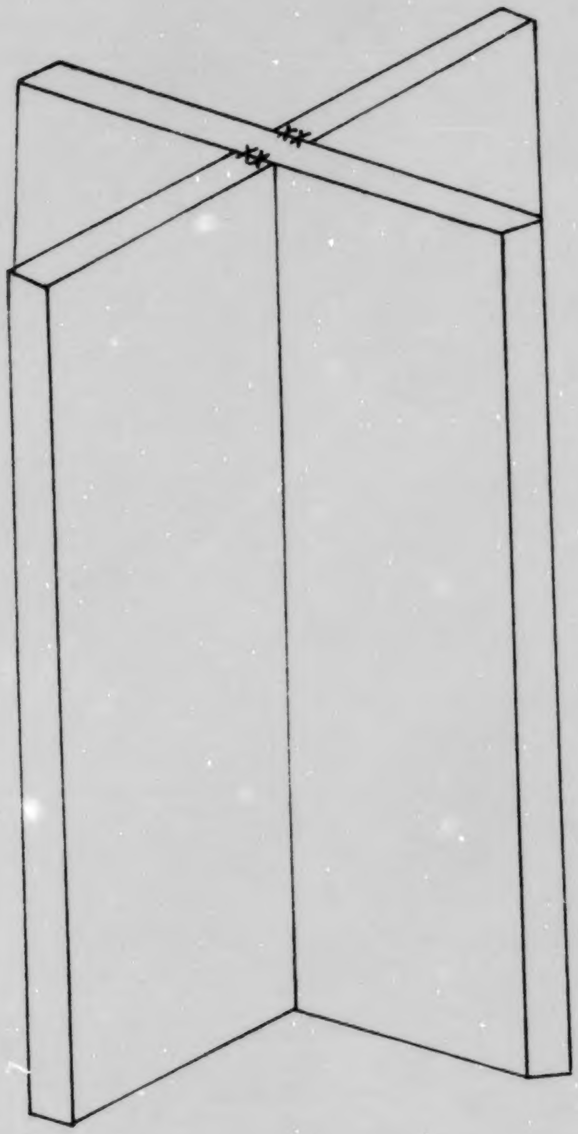
Positioning and Tacking Plates



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SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 6 OF 10

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Was surface ripple of the weld beads uniform?..........	___	___
2. Were welds free of undercut?..........................	___	___
3. Were leg lengths approximately equal?..................	___	___
4. Were throat sizes ¼" or more?..........................	___	___
5. Were welds free of porosity and slag inclusions?........	___	___
6. Was all weld splatter removed?..........................	___	___
7. Were all joints welded?................................	___	___

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

Enabling objective

Weld 6-pass tee joints: vertical position.

DUTY | TASK | EN. OBJ. | DEPT. | PROG.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the steps in positioning and welding 6-pass tee joints: vertical position.	1. a. PAT Workbook, Topic 14, Items 1-3, pages 34-36. b. Beseler Cue/See, Topic 14. c. Instruction Sheet enclosed; Weld Bead Sequence
2. Tackweld and position plates by following the procedure outlined in Resource No. 1.	2. a. Work station b. Tools c. Materials - 1 piece of 1/4" x 4" x 8" mild steel plate and 2 pieces of 1/4" x 2" x 8" mild steel plate
3. Weld 6-pass tee joints: vertical position. Have your instructor check your work.	3. a. Work station b. Tools
4. When you think you can attain this task, take the Knowledge Test.	4. Knowledge Test
5. When you successfully complete the Knowledge Test, take the Performance Test.	5. Performance Test

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 2 number PAGE 8 OF 10

DUTY

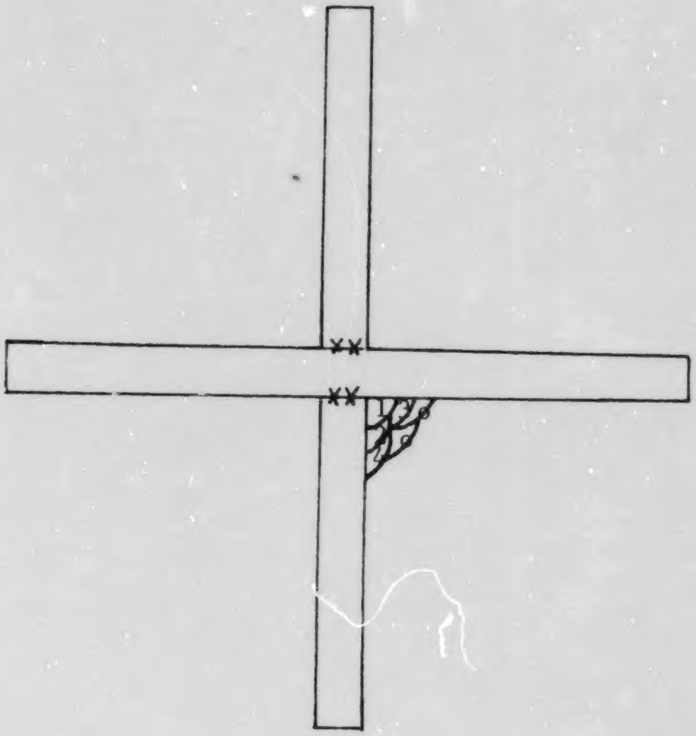
TASK

EN. OBJ.

DEPT.

PROG.

Weld Bead Sequence



PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 9 OF 10

DIRECTIONS:

Given access to equipment, metal, electrodes, and work station, you will weld multiple pass tee joints: vertical position. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were plates tackwelded to form a cross?		
2. Were plates tackwelded securely on both ends?		
3. Were leg lengths approximately equal on each weld joint?		
4. Were throat sizes 1/4" or more?		
5. Were weld faces slightly convex without sagging?		
6. Was surface ripple of all beads uniform?		
7. Were welds free of undercut and slag inclusion?		
8. Was last weld bead on the 6-pass welds deposited in the center of the joint?		
9. Was all slag and weld splatter removed?		
10. Were all joints welded?		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained
☐ Not attained

EVALUATOR

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DUTY

TASK

DEPT.

PROG.

Instructional Resources

Texts

------, PAT Workbook, Hobart School of Welding Technology, Troy, Ohio, 1975.

Audiovisual

Beseler Cue/See Filmstrip System, Charles Beseler Company, Florham Park, New Jersey, 1977.

Materials

Mils steel plate, E-6010 electrodes, and E-7018 electrodes

KNOWLEDGE TEST FOR ☐ ☐☐

duty task number

PAGE 1 OF 1

DUTY | TASK | DEPT. | PROG.

TASK: Weld Multiple Pass Tee Joints: Vertical Position

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet, circle Ⓣ if the item is True and Ⓕ if the item is False.

DO NOT MARK ON THIS TEST!

1. The root pass on a vertical weld is made using the whip and pause or inverted "T" motion.
2. Increasing the electrode angle as you travel upward will help you control the puddle.
3. The second pass of a 3-pass tee joint should be approximately three electrode diameters wide.
4. Whipping upward one to two electrode diameters allows the puddle to cool.
5. Pausing at the toe line when making a weave bead will cause undercut.
6. Holding a close arc length will give you better puddle control and less splatter.
7. When making a 6-pass tee weld vertically, the last bead should be deposited in the center of the weld joint.
8. Vertical up welding is faster than vertical down welding.
9. Vertical up welding is stronger than vertical down welding.
10. The surface ripples of the weld beads should be 1/16" to 3/32" apart.

NOWLEDGE TEST ANSWER KEY

DUTY	TASK	DEPT	PROG.

ltiple Choice questions

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STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 2 OPERATING ARC WELDING EQUIPMENT

TASK: 1 3 Weld Outside Corner Joints: Vertical Position

PURPOSE:

DRAFT

The outside corner joint is frequently used in the manufacture of tanks, storage bins and other types of containers because of the metal requiring no preparation for welding. It is important that the welder attain the skills needed to perform this weld in the vertical position.

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DUTY
TASK
PREREQ.
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DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:
(include condition, performance, and standard)

GIVEN: access to equipment, tools, metal, and a work station,

YOU WILL: weld outside corner joints; vertical position.

HOW WELL: You must successfully complete the Knowledge Test.

Your performance will be assessed by your instructor using the Performance Test on page 8.

ENABLING OBJECTIVES:

1. Prepare to weld outside corner joints.
2. Weld outside corner joints.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE ☐ number

PAGE 4 OF 9

DUTY | TASK | EN. OBJ. | DEPT. | PROG.

Enabling objective:

Prepare to weld outside corner joints.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine how to tackweld plates for outside corner joints.	1. Instruction Sheet enclosed, Tackwelding Outside Corner Joints
2. View Resource No. 2 to determine how to weld outside corner joints.	2. Beseler Cue/See; Topic 15.
3. When you think you have the knowledge to perform this task, take the Knowledge Test.	3. Knowledge Test for task 2-13.

Tackwelding Outside Corner Joints

1. Position plates to leave approximately 1/16" space as shown in Figure 1 below.

2. Tackweld on inside of angle approximately 1/2" from each end.

3. Tackweld remaining plates to form three outside corner joints. as shown in Figure 2 below.

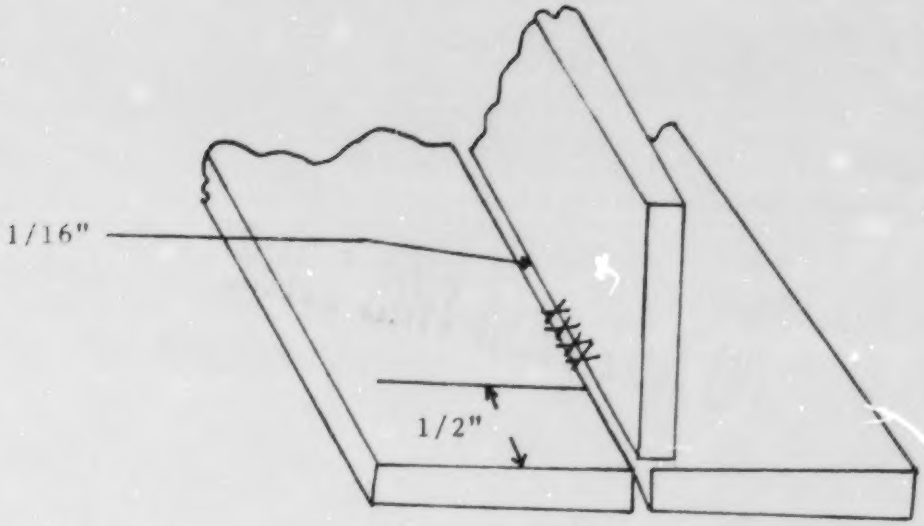

Figure 1

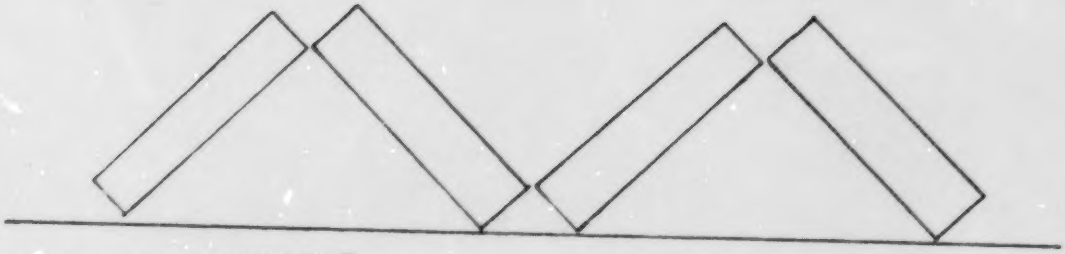

Figure 2

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE ☐ number

PAGE 6 OF 9

Enabling objective:

Weld outside corner joints.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Tackweld plates.	1. a. Work station b. Equipment c. Tools d. Material - four pieces of 1/2" x 2" x 8" mild steel plate
2. Weld outside corner joints.	2. a. Work station b. Equipment c. Tools d. Materials
3. Have instructor check your work.	3. Instructor
4. Evaluate your work by completing the Self-Check.	4. Self-Check enclosed.
5. When you are sure you can perform this task, take the Performance Test.	5. Performance Test for task 2-13.

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

SELF-CHECK FOR ENABLING OBJECTIVE ☐ number

PAGE 7 OF 9

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below. All items should receive a "YES" response.

	YES	NO
1. Was there 100% penetration on all finished welds?..........	___	___
2. Were the throat sizes at least as thick as the base metal?.	___	___
3. Were the welds free of porosity and slag inclusions?.......	___	___
4. Was the surface ripple uniform on all welds?...............	___	___
5. Were the weld joints full and slightly rounded?............	___	___

If you received a "NO" repsonse for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ duty ☐☐ task number

PAGE 8 OF 9

DIRECTIONS:

Given access to equipment, tools, metal plates, electrodes and a work station, you will weld outside corner joints in the vertical position. You will be evaluated on attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were the four plates tackwelded to form three outside corner joints?		
2. Was there 100% penetration on all finished welds?		
3. Were the weld joints full and weld faces slightly rounded?		
4. Was the surface ripple of all beads uniform?		
5. Were the welds free of porosity and slag inclusions?		
6. Were the weld joints full from end to end?		
7. Was there a minimum of undercut along the edges of the welds?		
8. Was all slag and weld splatter removed?		
9. Were all the craters filled?		
10. Were all joints welded completely?		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained
☐ Not attained

EVALUATOR

DEPT.

PROG.

DUTY

TASK

DEPT.

PROG.

Instructional Resources

Audiovisuals

Beseler Cue/See Filmstrip System, Charles Beseler Company, Florham Park, New Jersey, 1977.

KNOWLEDGE TEST FOR 2 (duty) 1 3 (task number)

PAGE 1 OF 1

DUTY

TASK

DEPT.

PROG.

TASK: Weld Outside Corner Joints: Vertical Position

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet, circle Ⓣ if the item is True and Ⓕ if the item is False.

DO NOT MARK ON THIS TEST!

1. To obtain 100% penetration, you must carry a keyhole when making the root pass.
2. The weld face should be slightly rounded and at least as thick as the base metal on an outside corner weld.
3. You need to hold a longer arc length when making a vertical weld.
4. The electrode should be angled (pointed) upwards approximately 5° to 10° when welding an outside corner vertically.
5. The first weave bead should be approximately three electrode diameters wide.
6. It may be necessary to deposit more than three weld beads in order to fill the joint completely.
7. A vertical up weld is not as strong as one made vertical down.
8. Tackwelding the plates on the inside of the angle will help prevent the space from closing as you make the root pass.
9. The surface ripples of the weld beads should be approximately 3/16" apart.
10. If the weld bead sags down in the center it is an indication that the puddle is too hot or too large.

KNOWLEDGE TEST ANSWER KEY

DUTY
TASK
DEPT.
PROG.

Multiple Choice questions

___1. ___7. ___13. ___19. ___25. ___31. ___37. ___43. ___49.
___2. ___8. ___14. ___20. ___26. ___32. ___38. ___44. ___50.
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___4. ___10. ___16. ___22. ___28. ___34. 40. ___46.
___5. ___11. ___17. ___23. ___29. ___35. ___41. ___47.
___6. ___12. ___18. ___24. ___30. ___36. ___42. ___48.

Matching questions

___1. ___7. ___13. ___19. ___25. ___31. ___37. ___43. ___49.
___2. ___8. ___14. ___20. ___26. ___32. ___38. ___44. ___50.
___3. ___9. ___15. ___21. ___27. ___33. ___39. ___45.
___4. ___10. ___16. ___22. ___28. ___34. ___40. ___46.
___5. ___11. ___17. ___23. ___29. ___35. ___41. ___47.
___6. ___12. ___18. ___24. ___30. ___36. ___42. ___48.

True-False questions

[✓] F 1. T F 11. T F 21. T F 31. T F 41.
[✓] F 2. T F 12. T F 22. T F 32. T F 42.
[✓ F] 3. T F 13. T F 23. T F 33. T F 43.
[✓] F 4. T F 14. T F 24. T F 34. T F 44.
[✓] F 5. T F 15. T F 25. T F 35. T F 45.
[✓] F 6. T F 16. T F 26. T F 36. T F 46.
[✓ F] 7. T F 17. T F 27. T F 37. T F 47.
[✓] F 8. T F 18. T F 28. T F 38. T F 48.
[✓ F] 9. T F 19. T F 29. T F 39. T F 49.
[✓] F 10. T F 20. T F 30. T F 40. T F 50.

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

DUTY 2
TASK 14
PREREQ.
DEPT. IN
PROG. 9943
REVISED

PROGRAM: WELDING

DUTY: 2 OPERATING ARC WELDING EQUIPMENT

TASK: 1 4 Weld Butt Joints: Vertical Position

PURPOSE:

DRAFT

Many fabrication and structural jobs require butt welds in 1/4" thick metal. It is most important that the welder attain the skills needed to perform this weld in the vertical position because it is not possible to always position the plates for flat position welding.

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OBJECTIVES

PAGE 3 OF 8

DUTY 2
TASK 14
DEPT. IN
PROG. (9943

PERFORMANCE OBJECTIVE:
(Include condition, performance,
and standard)

GIVEN: access to equipment, tools, metal and a work station,

YOU WILL: weld butt joints: vertical position.

HOW WELL: You must successfully complete the Knowledge Test.

Your performance will be assessed by your instructor using the Performance Test on page 7.

ENABLING OBJECTIVES:

1. Tackweld a series of butt welds in the vertical position.
2. Weld a series of butt welds in the vertical position.

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LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number PAGE 4 OF 8

DUTY 2 | TASK 14 | EN. OBJ. 1 | DEPTIN | PROG. 9943

Enabling objective:

Tackweld a series of butt welds in the vertical position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify steps in tackwelding butt joints.	1. PAT Workbook, - Topic 16, page 40.
2. Tackweld butt joints by following the steps in Resource No. 1.	2. a. Work station b. Equipment c. Tools d. material - five pieces of 1/4" x 2" x 8" mild steel plate
3. Have instructor check your work.	3. Instructor
4. Go on to Enabling Objective No. 2.	

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 5 OF 8

DUTY 2 | TASK 14 | EN. OBJ. 2 | DEPT. IN | PROG. 9943

Enabling objective:

Weld a series of butt welds in the vertical position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify how to position and weld butt joints.	1. a. PAT Workbook - Topic 16, pages 40-42. b. Beseler Cue/See; Topic 16
2. Position and weld butt joints by following the steps in Resource No. 1.	2. a. Work station b. Equipment c. Tools d. Materials
3. Have instructor check your work.	3. Instructor
4. Evaluate your work by completing the Self-Check.	4. Self-Check enclosed.
5. When you think you can attain this task, take the Knowledge Test.	5. Knowledge Test for task 2-14.
6. When you successfully complete the Knowledge Test, take the Performance Test.	6. Performance Test for task 2-14.

SELF-CKECK FOR ENABLING OBJECTIVE 2 number PAGE 6 OF 8

DUTY	TASK	EN. OBJ.	DEPT.	PROG.
2	14	2	IN	9943

DIRECTIONS:

Evaluate your work by answering the items below. All items should receive a "YES" response.

	YES	NO
1. Was there 100% penetration on all welds?	___	___
2. Was all of the undercut left by the first pass completely covered by the cover pass?	___	___
3. Was the cover pass convex and slightly higher than the base metal?	___	___
4. Was the weld joint full from end to end?	___	___
5. Was the surface ripple of the weld beads uniform?	___	___

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR 2 (duty) 14 (task number)

PAGE 7 OF 8

DIRECTIONS:

Given access to equipment, tools, metal plates, and a work station, you will tackweld and weld a series of butt joints in the vertical position. You will be evaluated on attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were the plates tackwelded according to instructions?............		
2. Was there 100% penetration on all welds?............		
3. Was all undercut completely covered by the cover passes?............		
4. Were the cover passes convex and slightly higher than the plate surfaces?............		
5. Were the welds free of porosity and slag inclusions?............		
6. Was all slag and weld splatter removed?............		
7. Were the weld joints full from end to end?............		
8. Was the surface ripple of the beads uniform?............		
9. Were all craters filled?............		
10. Were all joints welded?............		

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DUTY 2
TASK 14
ATTEMPT
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EVALUATOR
DEPT. IN
PROG. 9943

LIST OF RESOURCES, MATERIALS, AND EQUIPMENT PAGE 8 OF 8

DUTY 2
TASK 14
DEPT. IN
PROG. 9943

Instructional Resources

Texts

------, PAT Workbook, Hobart School of Welding Technology, Troy Ohio. 1975.

Audiovisual

Beseler Cue/See Filmstrip System, Charles Beseler Company, Florham Park, New Jersey, 1977.

Materials

Mild steel plate and E-6010 electrodes

KNOWLEDGE TEST FOR 2 | 1 4

duty task number

PAGE 1 OF 1

DUTY

TASK

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TASK Weld Butt Joints: Vertical Position

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet, circle Ⓣ if the item is True and Ⓕ if the item is False.

DO NOT MARK ON THIS TEST!

1. The plates should be butted tightly together when making a butt weld.
2. If penetration is incomplete, decrease travel speed and/or increase amperage.
3. A whipping motion to melt the edges of the plates will help you attain complete penetration.
4. When making the root pass, you should use a 45° push angle.
5. The cover pass is made using a "Z-weave" or inverted "C-motion".
6. You must pause at the toe line of the previous bead to fill the undercut.
7. If the cover pass sags in the center, it is because the amperage is too low.
8. Slag may be trapped in the weld if you do not come back into the puddle enough on the cover pass.
9. If you have complete penetration, the weld face does not have to be higher than the base metal.
10. The bead ripples should be 1/16" to 3/32" apart.

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KNOWLEDGE TEST ANSWER KEY

DUTY
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Multiple Choice questions

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True-False questions

T [✓ F] 1.
[✓ T] F 2.
[✓ T] F 3.
T [✓ F] 4.
[✓ T] F 5.
[✓ T] F 6.
T [✓ F] 7.
[✓ T] F 8.
T [✓ F] 9.
[✓ T] F 10.
T F 11.
T F 12.
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STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 2 OPERATING ARC WELDING EQUIPMENT

TASK: 1 5 Weld Single and Multiple Pass Lap Joints: Overhead Position

PURPOSE:

Many metal structures cannot be moved or positioned for welding. It is necessary that the welding be performed in all positions. The welder must be able to perform these welds in the overhead position.

DRAFT

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DUTY
TASK
PREREQ.
DEPT.
PROG.
REVISED

OBJECTIVES PAGE 3 OF 8

DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:
(include condition, performance,
and standard)

GIVEN: access to equipment, tools, metal, and a work station,

YOU WILL: tackweld and weld a series of single and multiple pass lap welds in the overhead position.

HOW WELL: You must successfully complete the Knowledge Test.

Your perfromance will be assessed by your instructor using the Performance Standards on page 7.

ENABLING OBJECTIVES:

1. Weld single pass lap joints in the overhead position.
2. Weld multiple pass lap joints in the overhead position.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE

1
number

PAGE 4 OF 8

DUTY | TASK | EN. OBJ. | DEPT. | PROG.

Enabling objective:

Weld single pass lap joints in the overhead position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine how to tackweld a series of lap joints.	1. PAT Workbook _ Topic 5, items 1-2, page 46
2. Tackweld lap joints by following the steps in Resource No. 1.	2. a. Work Station b. Equipment c. Tools d. Material - five pieces of 3/16" x 3" x 8" mild steel plate
3. Use Resource No. 3 to identify how to position and weld single pass lap joints in the overhead position.	3. PAT Workbook - Topic 18, Items 1-3, pages 46-47
4. Position and weld single pass lap joints in the overhead position by following the steps in Resource No. 3.	4. a. Work station b. Equipment c. Tools d. Material
5. Have instructor check your work.	5. Instructor
6. Evaluate your work by completing the Self-Check.	6. Self-Check enclosed.
7. Go on to Enabling Objective No. 2.	

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SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 5 OF 8

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below. All items should receive a "YES" response.

	YES	NO
1. Were the welds free of undercut?........................	___	___
2. Were the welds free of slag and rollover?................	___	___
3. Were the weld joints filled completely?..................	___	___
4. Were the surface ripples of all weld beads uniform?......	___	___
5. Was all slag and weld splatter removed?..................	___	___
6. Were the joints covered by the welds from end to end?....	___	___

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If you received a "NO" response for *any* item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 6 OF 8

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Weld multiple pass lap joints int he overhead position

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Tackweld lap joints using Resource No. 1.	1. a. Work station b. Equipment c. Tools d. Material - five pieces of 3/8" x 3" x 8" mild steel plate
2. Read Resource No. 2 to identify how to position and weld multiple pass lap joints in the overhead position.	2. PAT Workbook - Topic 19, Items 2-3, pages 48-49.
3. Position and weld multiple pass lap joints in the overhead position by following the steps in Resource No. 2.	3. a. Work station b. Equipment c. Tools d. Materials
4. When you think you can attain this task, take the Knowledge Test.	4. Knowledge Test for task G-15.
5. When you successflly complete the Knowledge Test, take the Performance Test.	5. Performance Test for task G-15.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 7 OF 8

DIRECTIONS:

Given access to equipment, tools, metal plates, and a work station, you will weld a series of single and multiple pass lap welds in the overhead position. You will be evaluated on attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were the plates overlapped approximately 1/2 the width when tackwelded?		
2. Were the weld joints full from end to end?		
3. Were the throat sizes approximately equal to the thickness of the plate?		
4. Were the leg lengths approximately equal?		
5. Was the second pass of the multiple pass welds placed against the bottom plate?		
6. Were the welds fused with the bottom edge of the bottom plate without sag or rollover?		
7. Was the surface ripple of all weld beads uniform?		
8. Were the welds free of undercut?		
9. Was all slag and weld splatter removed?		
10. Were all joints welded on both sides of plates?		

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DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

DUTY

TASK

DEPT.

PROG.

Instructional Resources

Texts

------, PAT Workbook, Hobart School of Welding Technology, Troy, Ohio, 1975.

State Department of Vocational and Technical Education, Module: "Vocational Trade and Industrial Education - Welding", Oklahoma State Board of Vocational and Technical Education, Stillwater, Oklahoma, 1974.

Audiovisual

Beseler Cue/See Filmstrip System, Charles Beseler Company, Florham Park, New Jersey, 1977.

Materials

Mild steel plate and E-6010 electrodes

KNOWLEDGE TEST FOR ☐ ☐☐ PAGE 1 OF 1

duty task number

TASK: Weld Single and Multiple Pass Lap Joints in the Overhead Position

DUTY

TASK

DEPT.

PROG.

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet, circle T if the item is True and F if the item is False.

DO NOT MARK ON THIS TEST!

The plates should be positioned at "arms length" overhead height to weld.

You should lean the electrode approximately 45° in the direction of travel when welding overhead.

You should melt off approximately 1/16" of the bottom edge on a single pass lap weld.

If the puddle gets too large or too hot, the weld metal will sag or fall.

The second pass of a multiple pass weld should be placed against the upper plate.

The whip and pause motion works best when overhead welding.

Undercutting will most likely occur on the upper plate.

Holding a longer arc length is necessary when welding overhead.

The third pass of a three pass fillet weld should be centered over the upper toe of the root pass.

The weld should fuse and fill the bottom edge on a multiple pass lap weld.

KNOWLEDGE TEST ANSWER KEY

DUTY

TASK

CEPT

PROG

Multiple Choice questions

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True-False questions

T [✓ F] 1.
T [✓ F] 2.
[✓ T] F 3.
[✓ T] F 4.
T [✓ F] 5.
[✓ T] F 6.
[✓ T] F 7.
T [✓ F] 8.
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Matching questions

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STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

DUTY

TASK

PREREQ.

DEPT.

PROG.

REVISED

PROGRAM: WELDING

DUTY: 2 OPERATING ARC WELDING EQUIPMENT

TASK: 1 6 Weld Mulitple Pass "Tee Joints: Overhead Position

PURPOSE:

The "tee" joint is the most common weld joint used in welding. It must be performed in all positions. Therefore, it is most important that the welder attain the competency necessary to weld this joint in the overhead position.

DRAFT

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PERFORMANCE OBJECTIVE:
(Include condition, performance,
and standard)

GIVEN: access to equipment, tools, metal, and a work station,

YOU WILL: tackweld and weld a series of multiple pass "tee" joints in the overhead positon.

HOW WELL: You must successfully complete the Knowledge Test.

Your performance will be assessed by your instructor using the Performance Standards on page 9.

ENABLING OBJECTIVES:

1. Tackweld and weld three-pass "tee" joints in the overhead position.
2. Tackweld and weld six-pass "tee" joints in the overhead position.

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LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1

number

Enabling objective

Tackweld and weld three-pass "tee" joints in the overhead position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Reosurce No. 1 to determine how to tackweld "tee" joints.	1. PAT Workbook - Topic 8, Item 2, page 20.
2. Tackweld "tee" joints by following the directions in Resource No. 1.	2. a. Work station b. Equipment c. Tools d. Material - five pieces of 1/4" x 3" x 8" mild steel plate
3. Use Resource No. 3 to determine how to weld a three-pass "tee" joint in the overhead position.	3. a. PAT Workbook - Topic 19, Items 2-3. pages 48-49
4. Position and weld three-pass "tee" joints in the overhead position by following the steps in Resource No. 3.	4. a. Work station b. Equipment c. Tools d. Materials: tackwelded "tee" joints
5. Have instructor check your work.	5. Instructor
6. Evaluate your work by completing the Self-Check.	6. Self-Check enclosed.
7. Go on to Enabling Objective No. 2.	

SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 5 OF 10

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below. All items should receive a "YES" response.

	YES	NO
1. Were the leg lengths of the welds approximately equal?..		
2. Were the welds free of undercut?......................		
3. Were the weld beads overlapped without rollover?........		
4. Were the surface ripples of all weld beads uniform?.....		
5. Were the welds free of slag entrapment and porosity?....		
6. Were the weld joints full from end to end?.............		
7. Was all of the weld splatter removed?..................		

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2

number

PAGE 6 OF 10

Enabling objective

Tackweld and weld six-pass "tee" joints in the overhead position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Reosurce No. 1 to determine the weld bead sequence when welding a six-pass "tee" joint.	1. Instruction Sheet enclosed, Weld Bead Sequence for Six-Pass "Tee" Joints in the Overhead Postion
2. Weld six-pass "tee" joints by following the steps in Resource No. 1.	2. a. Work station b. Equipment c. Tools d. Material - five pieces of 1/4" x 3" x 8" mild steel plate
3. Evalaute your work by completing the Self-Check.	3. Self-Check enclosed.
4. When you think you can attain this task, take the Knowledge Test.	4. Knowledge Test
5. When you successfully complete the Knowledge Test, take the Performance Test.	5. Performance Test

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 2 number PAGE 7 OF 10

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Weld Bead Sequence for Six-Pass "Tee" Joints in the Overhead Position

1. Tackweld five plates to form eight "tee" joints (refer to Figure 1).
2. Position and clamp in fixture for overhead welding (refer to Figure 1).
3. Deposit first three beads as you did in Enabling Objective No. 1.
4. Starting on bottom plate, deposit three more weld beads.
5. Weld remaining seven "tee" joints using same procedure.

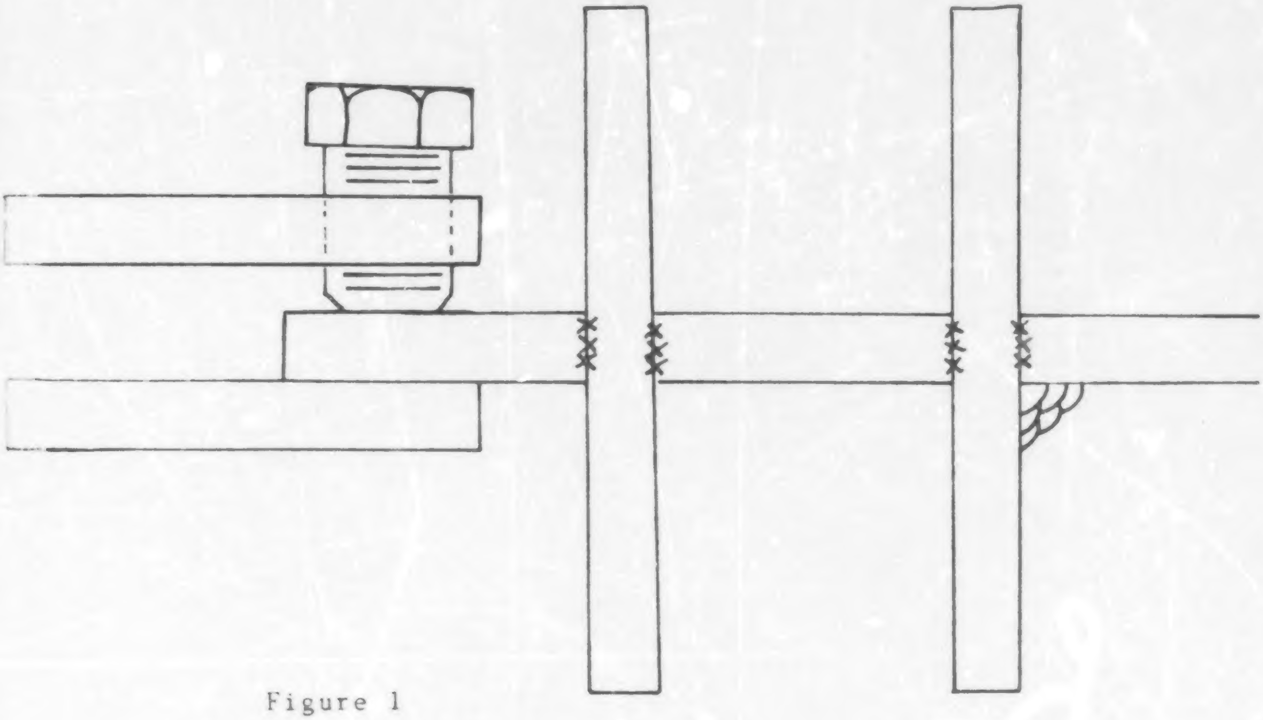

Figure 1

SELF-CHECK FOR ENABLING OBJECTIVE 2 number PAGE 8 OF 10

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below. All items should receive a "YES" response.

	YES	NO
1. Were the leg lengths of the welds approximately equal?....		
2. Were the welds free of undercut?..........................		
3. Were the weld beads overlapped without rollover?..........		
4. Were the surface ripples of all weld beads uniform?.......		
5. Were the welds free of slag entrapment and porosity?......		
6. Were the weld joints full from end to end?................		
7. Was all weld splatter removed?............................		

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 9 OF 10

DIRECTIONS:

Given access to equipment, tools, metal and a work station, you will weld both three-pass and six-pass "tee" joints in the overhead position. You will be evaluated on attainmnet of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were the welds free of undercut, porosity and slag entrapment?		
2. Were the joints welded from end to end without "cold starts"?		
3. Were the leg lengths approximately equal?		
4. Were the weld beads overlapped without rollover?		
5. Were the weld beads deposited in the proper sequence?		
6. Was the surface ripple of the weld beads uniform?		
7. Was all of the slag and weld splatter removed?		
8. Were the weld faces slightly convex rather than concave?		
9. Was distortion held to a minimum?		
10. Were all joints welded?		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained
☐ Not attained

EVALUATOR

DEPT.

PROG.

DUTY

TASK

DEPT.

PROG.

Instructional Resources

Texts

------, PAT Workbook, Hobart School of Welding Technology, Troy, Ohio, 1975.

State Department of Vocational and Technical Education, Module: "Vocational Trade and Industrial Education - Welding", Oklahoma State Board of Vocational and Technical Education, Stillwater, Oklahoma, 1974.

Audiovisual

Beseler Cue/See Filmstrip System, Charles Beseler Company, Florham Park, New Jersey, 1977.

Materials

Mild steel plate and E-6010 electrodes

KNOWLEDGE TEST FOR ☐ ☐☐

duty task number

PAGE 1 OF 1

DUTY

TASK

DEPT.

PROG.

TASK: Weld Multiple Pass "Tee" Joints: Overhead Position

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet, circle T if the item is True and F if the item is False.

DO NOT MARK ON THIS TEST!

1. The weld bead sequence should be from the lower plate to the upper plate when welding overhead.
2. A "cold start" at the beginning of the weld bead can be eliminated by striking the arc ahead and quickly moving back to the beginning point.
3. By carrying a larger puddle, you can prevent weld bead sag when welding overhead.
4. Incorrect electrode angle may cause the weld bead to roll over at the toe.
5. Undercutting the upper plate is a major problem when welding "tee" joint overhead.
6. The leg length should be longer on the lower plate of a "tee" joint overhead.
7. It is usually necessary to lower your amperage when welding overhead.
8. The second pass of a three-pass "tee" joint should be centered over the lower toe of the root pass.
9. You should lean the electrode 10° to 15° in the direction of travel when welding overhead.
10. Overhead position means over your head when standing

KNOWLEDGE TEST ANSWER KEY

DUTY

TASK

DEPT

PROG

Multiple Choice questions

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True-False questions

[✓ T] F 1.
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[✓ T] F 5.
T [✓ F] 6.
T [✓ F] 7.
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Matching questions

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STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

DUTY

TASK

PREREQ.

DEPT.

PROG.

REVISED

PROGRAM: WELDING

DUTY: 1 OPERATING GAS WELDING EQUIPMENT

TASK: 0 3 Gas Weld Carbon Steel Joints

PURPOSE:

The skill to join metals together by using the gas welding process can only be obtained after a careful study of the methods and practice. Gas Welding can become a very rewarding part of your career in the welding industry.

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OBJECTIVES

PAGE 3 OF 27

DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:
(Include condition, performance,
and standard)

GIVEN: access to oxyacetylene safety and welding equipment, tools, 16 gauge mild steel, and a mild steel filler rod.

YOU WILL: gas weld carbon steel joints,

HOW WELL: You must successfully complete the Knowledge Tests. Your peformance will be assessed by your instructor using the Performance Tests on pages 10, 14, 18, and 22.

ENABLING OBJECTIVES:

1. Define terms used in this Learning Guide.
2. Tack thin gauge plates and make butt welds.
3. Tack thin gauge plates and make outside corner welds.
4. Tack thin gauge plates and make lap welds.
5. Tack thin gauge plates and make tee fillet welds.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number PAGE 4 OF 27

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Enabling objective:

Define terms used in this Learning Guide.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to define the welding terms used in this Learning Guide.	1. Instruction Sheet enclosed, Welding Terms
2. Evaluate your knowledge by completing the Self-Check.	2. Self-Check enclosed.
3. Go on to Enabling Objective No. 2.	3

Welding Terms

1. Puddle - a portion of a weld that is molten at the place the heat is supplied.
2. Neutral flame - a flame which results from combustion of perfect (equal) parts of oxygen and welding gas.
3. Undercut - a depression at the toe of the weld which is below the surface of the base metal.
4. Toe of weld - the junction of the face of weld and the base metal.
5. Oxidizing flame - flame produced by an excess of oxygen in the torch mixture.
6. Penetration - an extent of fusion into base metal.
7. Carburizing flame - flame produced by an excess of acetylene in the torch mixture.
8. Fuse or fusion - a complete melting together of the base metal and the welding rod.
9. Joint - the intersection of two pieces of metal to be joined by welding.
10. Convex weld - a weld with the face above the weld edges.

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SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 6 OF 27

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your knowledge by answering the items below on a separate sheet of paper.

1. __________ is a flame which results from combustion of perfect (equal) parts of oxygen and welding gas.

2. The junction of the face of the weld and the base metal is __________.

3. A weld with the face above the weld edges is a __________.

4. __________ is a portion of a weld that is molten at the place the heat is supplied.

5. An extent of fusion into base metal is __________.

6. Flame produced by an excess of acetylene in the torch mixture is __________.

7. __________ is a depression at the toe of the weld which is below the surface of the base metal.

8. The intersection of two pieces of metal to be joined is a __________.

9. Flame produced by an excess of oxygen in the torch mixture is __________.

10. A complete melting together of the base metal and the welding rod is __________.

Now check your answers with the Answer Key.

SELF-CHECK FOR ENABLING OBJECTIVE 1 number
ANSWER KEY

PAGE 7 OF 27

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

1. neutral flame
2. toe of weld
3. convex weld
4. puddle
5. penetration
6. carburizing flame
7. undercut
8. joint
9. oxidizing flame
10. fusion

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2

number

PAGE 8 OF 27

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

enabling objective

Tack thin gauge plates and make butt welds.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No.1 to identify and locate equipment, tools, and materials.	1. Instruction Sheet enclosed, Procedure for Selecting Tools, Equipment, and Materials
2. Assemble equipment, tools, and materials at your work station following the procedure outlined in Resource No.1.	2. a. Safety and Welding equipment b. Tools c. Materials
3. Use Resource No.1 to identify the procedure for setting up plates and tackwelding a butt joint.	3. a. PAT Workbook, Topic 10. b. Beseler Cue/See, Topic 10.
4. Setup plates, tackweld and practice making butt welds making butt welds by following the procedure outlined in Resource No.3.	4. a. Safety and welding equipment b. Tools c. Materials
5. Read Resource No.5 to identify the procedure for testing welds. Have your instructor check your work.	5. a. Text: Basic Oxyacetylene Welding, Unit 16, page 47, Procedure 5. b. Tools
6. When you think you can attain this task, take the Knowledge Test.	6. Knowledge Test

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 9 OF 27

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Track thin gauge plates and make butt welds.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
7. When you succsessfully complete the Knowledge Test, take the Peformance Test.	7. Performance Test
8. Go on to Enabling Objective No.3.	

7.1

Procedure for Selecting Tools, Equipment, and Materials

1. Obtain the following items from your locker:

   a. Oxyacetsylene goggles No. 5 shade lens

   b. Gloves

   c. Striker

   d. Wire brush

CAUTION: CHECK GOGGLES FOR CRACKED OR BROKEN LENS!

2. Obtain the following items from the tools crib:

   a. W-17 welding head size No. 6

   b. 12 pieces 3/32" x 36" mild steel welding rod

   c. 1 32 ounce ball peen hammer

   d. Tongs

3. Obtain the following items from the metal storage area:

   a. 12 pieces of 16 gauge x 2" x 8" mild steel

PERFORMANCE TEST FOR ☐ ☐☐
duty task number

PAGE 11 OF 27

DIRECTIONS:

Given access to standard oxyacetylene safety and welding equipment, tools, and materials, you will tack thin gauge plates and make butt welds. Obtain 4 pieces of 16 gauge x 2" x 8" mild steel. Tackweld and weld to make two butt joints. The butt weld should have complete fusion of the joint, full penetration, proper bead width and contour, no undercut, and pass the bend test. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were plates cleaned of all rust and oil before setting up to weld?		
2. Was the torch adjusted for a neutral flame?		
3. Were plates spaced correctly before making the initial tackweld?		
4. Was a tackweld made every two inches along the full length of the plate?		
5. Were weld beads uniform in width and approximately six times as wide as the thickness of metal?		
6. Was there complete fusion and full penetration with no undercut?		
7. Was bend test passed without evidence of cracking?		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained
☐ Not attained

EVALUATOR

DEPT.

PROG.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 3

number

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Enabling objective:

Tack thin gauge plates and make outside corner welds.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify and locate the proper size weld rod and metal plates for outside corner welds.	1. Instruction Sheet enclosed, *Procedure for Selecting Welding Rod and Mild Steel*
2. Assemble equipment, tools, and materials at your work station by following the procedure outlined in Resource No. 1.	2. a. Safety and welding equipment b. Tools c. Materials
3. Read Resource No. 3 to identify the procedure for setting up plates, tackwelding, and welding outside corner joints.	3. Instruction Sheet enclosed *Procedure for Setting up and Tackwelding an Outside Corner Joint*
4. Setup plates, tackweld and practice welding outside corner joints by following the procedure outlined in Resource No.3.	4. a. Safety and welding equipment b. Tools c. Material
5. Read Resource No. 5 to identify the procedure for testing welds. Have instructor check your work.	5. a. Text: *Basic Oxyacetylene Welding*, Unit 17, page 48, Procedure 5. b. Tools
6. When you think you can attain this task, take the Knowledge Test.	6. Knowledge Test

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 3

number

PAGE 13 OF 27

DUTY | TASK | EN. OBJ. | DEPT. | PROG.

Enabling objective

Tack thin gauge plates and make outside corner welds.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
7. When you successfully complete the Knowledge Test, take the Performance Test.	7. Performance Test
8. Go on to Enabling Objective No. 4.	

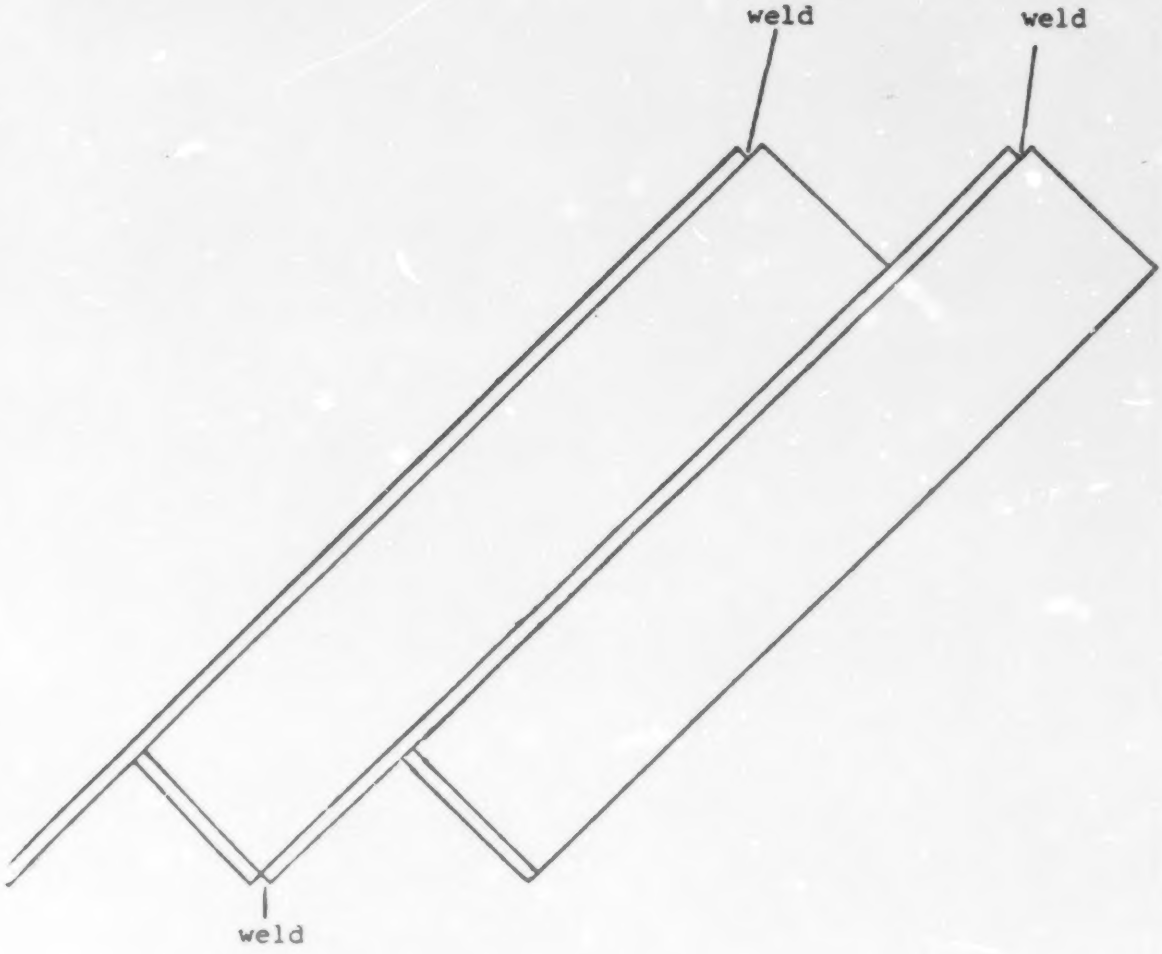
Procedure for Selecting Welding Rod and Mild Steel

1. Obtain the following items:
   - a. Oxyacetylene goggles No. 5 shade lens
   - b. Gloves
   - c. Striker
   - d. Wire brush

CAUTION: CHECK GOGGLES FOR CRACKED OR BROKEN LENS!

2. Obtain the following items from the tool crib:
   - a. W-17 welding head size No.6
   - b. 12 pieces 1/16" x 36" mild steel welding rod
   - c. 1 32 ounce ball peen hammer
   - d. Tongs
3. Obtain the following items from the storage area:
   - a. 12 pieces of 16 gauge x 2" x 8" mild steel

Procedure for Setting Up and Tackwelding an Outside Corner Joint



Outside Corner Welds:

1. Do not overlap edges, leave a "vee" or open corner.

2. Tackweld each end of each corner joint.

3. Tackweld side opposite weld joint in two places, approximately 3" from each end.

4. Weld 3 outside corner joints.

12

PERFORMANCE TEST FOR ☐ ☐☐
duty task number

PAGE 16 OF 27

DIRECTIONS: Given access to standard oxyacetylene safety and welding equipment, tools, 16 gauge mild steel plate, and a mild steel filler rod. Obtain 4 pieces of 16 gauge x 2" x 8" mild steel. Tackweld to make three outside corner joints and weld the three joints. The outside corner joints must be uniform in width and appearance, have complete fusion to both sides of the joint, full penetration, and pass the bend test. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were plates cleaned of all rust and oil before setting up to weld?..		
2. Was torch adjusted for a neutral flame?......................		
3. Was piece tackwelded every two inches along the full length of the plates?..		
4. Were weld beads uniform in width and appearance and slightly convex?..		
5. Was there complete fusion and full penetration ?..........		
6. Was bend test completed with no evidence of cracking?......		

DUTY
TASK
ATTEMPT
STUDENT
DATE
☐ Attained
☐ Not attained
EVALUATOR
DEPT.
PROG.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 4 number PAGE 17 OF 27

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Tack thin gauge plates and make lap joints.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify and locate the proper size weld rod and mild steel plate for lap welds.	1. Instruction Sheet enclosed, Procedure for Selecting Welding and Mild Steel
2. Assemble equipment, tools, and materials at your work station by following the procedure outlined in Resource No.1.	2. a. Safety and welding equipment b. Tools c. Materials
3. Read Resource No.3 to identify the procedure for setting up, tack-welding and welding a lap joint.	3. a. Text: Basic Oxyacetylene Welding, Unit 18, pages 51-52. b. Instruction Sheet enclosed Procedure for Setting Up and Tackwelding a Lap Joint
4. Setup, tackweld and practice welding lap joints by following the procedure outlined in Resource No.3.	4. a. Safety and welding equipment b. Tools c. Materials
5. Read Resource No.5 to identify the procedure for testing welds. Have your instructor check your work.	5. a. Text: Basic Oxyacetylene Welding, Unit 18, page 51, Procedure 4. b. Tools

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 4 number

DUTY | TASK | EN OBJ. | DEPT. | PROG.

Enabling objective

Tack thin gauge plates and make lap joints.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
6. When you think you can attain this task, take the Knowledge Test.	6. Knowledge Test
7. When you successfully complete the Knowledge Test, take the Performance Test.	7. Performance Test
8. Go on to Enabling Objective No.5.	

Procedure for Selecting Welding Rod and Mild Steel

1. Obtain the following items.

    a. Oxyacetaylene goggles and No.5 shade lens

    b. Gloves

    c. Striker

    d. Wire brush

CAUTION: CHECK GOGGLES FOR CRACKED OR BROKEN LENS!

2. Obtain the following items from the tool crib:

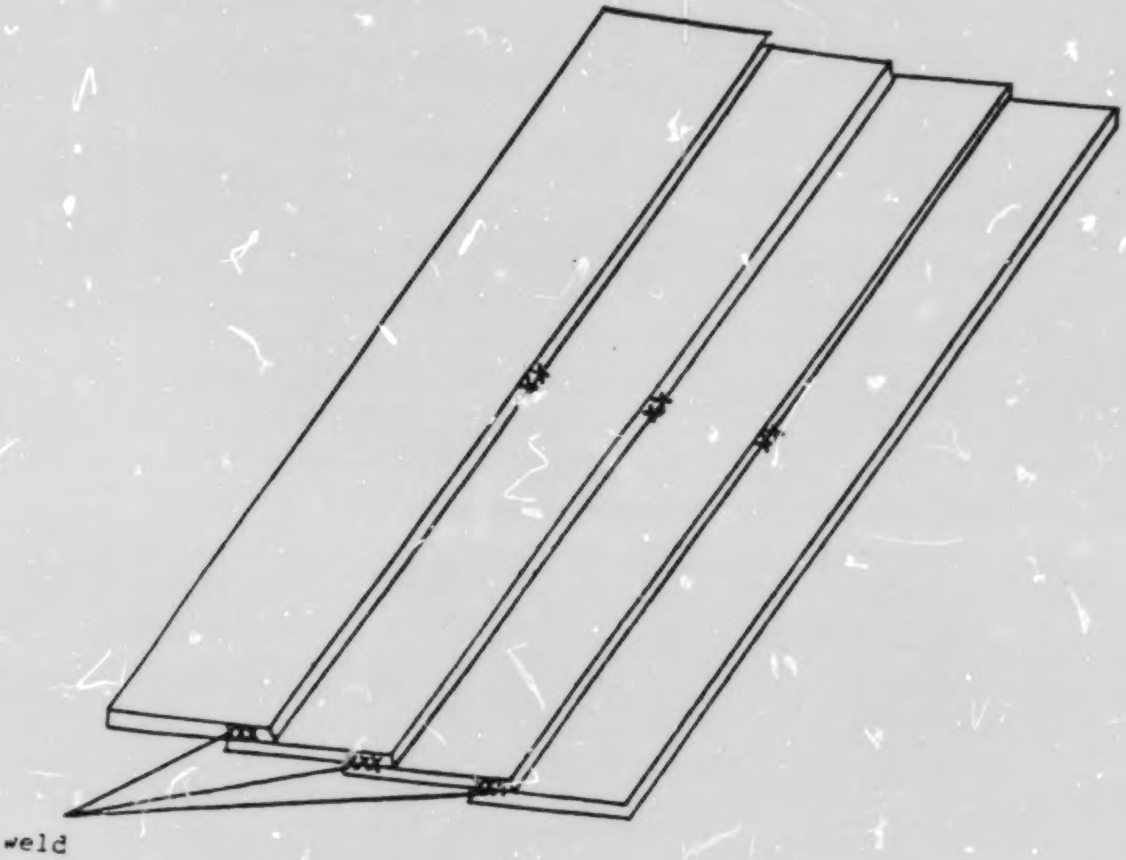
    a. W-17 welding head size No. 6

    b. 12 pieces of 3/32" x 36" mild steel welding rod

3. Obtain the following items from the metal storage area:

    a. 12 pieces of 16 gauge x 2" x 8" mild steel

Procedure for Setting Up and Tackwelding a Lap Joint



Lap welds:

1. Overlap pieces approximately 1/2".
2. Tackweld at each end - shown by xxx.
3. Tackweld in approximate center - shown by xx.
4. Weld joints on opposite side from tackwelds xx.
5. Make 3 lap welds.

17

PERFORMANCE TEST FOR ☐ ☐☐
duty task number

PAGE 21 OF 27

DIRECTIONS: Given access to standard oxyacetylene welding and safety equipment, tools, 16 gauge mild steel plates, and a mild steel filler rod. Obtain 4 pieces of 16 gauge x 2" x 8" mild steel. You will tackweld to make three lap weld joints and weld. The lap welds should be uniform in width and appearance, have proper contour, no undercut, properly fused to both plates, and pass the bend test. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were plates cleaned of all rust and oil before setting up to weld?..		
2. Was torch adjusted for a neutral flame?.........................		
3. Were plates overlapped the specified dimension?............		
4. Were tackwelds in specified location?..........................		
5. Were plates tightly together before welding?.................		
6. Was there adequate fusion to both plates?.....................		
7. Was there a complete absence of undercut?.....................		
8. Was proper contour, bead width, and uniformity of appearance maintained?..		
9. Was bend test completed and passed?............................		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained
☐ Not attained

EVALUATOR

DEPT.

PROG.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 5 number PAGE 22 OF 27

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Tack thin gauge plates and make tee fillet welds.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No.1 to identify and locate the proper size weld rod and mild steel plates for tee fillet welds.	1. Instruction Sheet enclosed, Procedure for Selecting Welding Rod and Mild Steel
2. Assemble equipment, tools, and materials at your work station by following the procedure outlined in Resource No.1.	2. a. Safety and welding equipment b. Tools c. Materials
3. Read Resource No. 3 to identify the procedure for setting up plates, tackwelding, and welding a tee fillet joint.	3. a. Text: Basic Oxyacetylene Welding, Unit 19, pages 53-55. b. Instruction Sheet enclosed Procedure for Setting Up and Tackwelding a Tee Joint
4. Setup, tackweld and practice welding tee joints by following the procedure outlined in Resource No.3.	4. a. Safety and welding equipment b. Tools c. Materials
5. Read Resource No.5 to identify the procedure for testing welds. Have instructor check your work.	5. a. Text: Basic Oxyacetylene Welding, Unit 19, page 54, Procedure 4. b. Tools

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 5 number

PAGE 23 OF 27

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Enabling objective:

Tack thin gauge plates and make tee fillet welds.

PROCEDURE	
LEARNING ACTIVITIES	RESOURCES
6. When you think you can attain this task, take the Knowledge Test.	6. Knowledge Test
7. When you successfully complete the Knowledge Test, take the Performance Test.	7. Performance Test
8. Secure your area.	

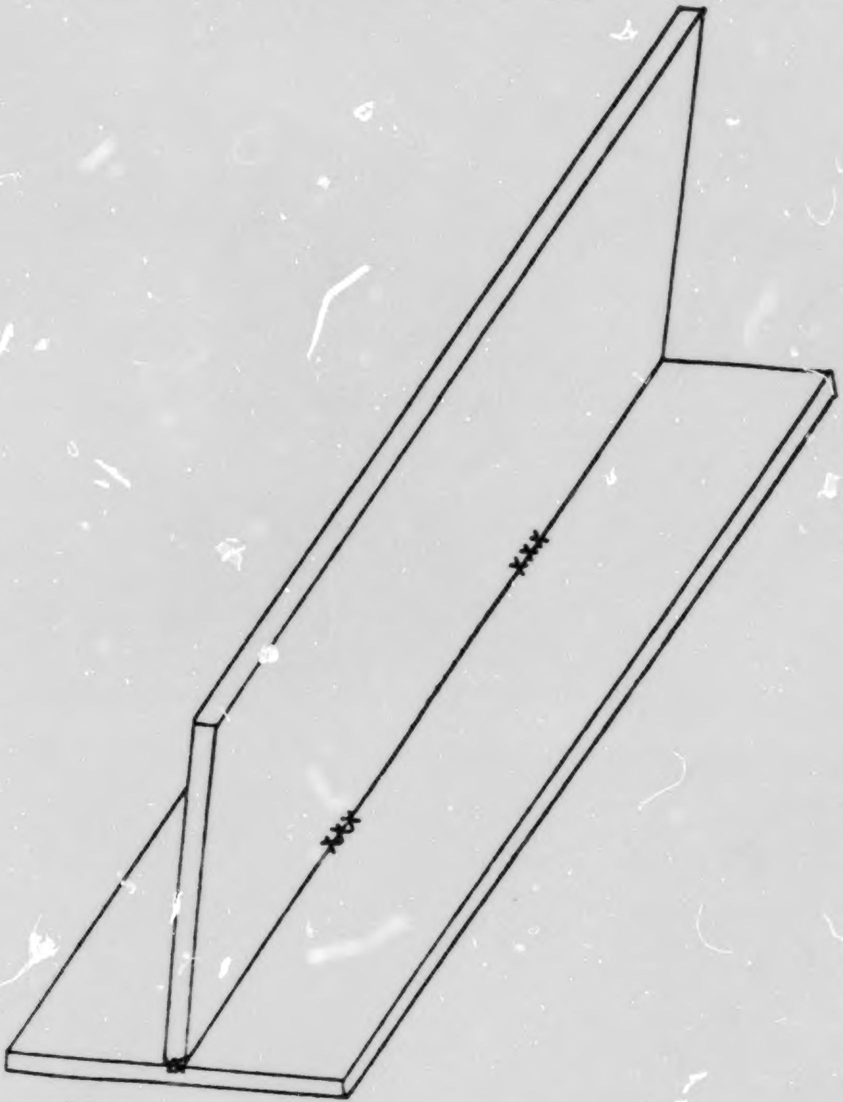
Procedure for Selecting Welding Rod and Mild Steel

1. Obtain the following items :
   - a. Oxyacetylene goggles No. 5 shade lens
   - b. Gloves
   - c. Striker
   - d. Wire brush

CAUTION: CHECK GOGGLES FOR CRACKED OR BROKEN LENS!

2. Obtain the following items from the tool crib:
   - a. W-17 welding head size No. 6
   - b. 12 pieces 3/32" x 36" mild steel welding rod
   - c. 1 32 ounce ball peen hammer
   - d. Tongs
3. Obtain the following items from the metal storage area:
   - a. 12 pieces of 16 gauge x 2" x 8" mild steel

Procedure for Setting Up and Tackwelding a Tee Joint



Tee welds:

1. Place 1 piece perpendicular to other piece and in approximate center of bottom piece.

2. Tackweld each end as shown by xx.

3. Tackweld two places on one side only as shown by xxx approximately 3" from each end.

4. Weld on side opposite tackwelds xxx.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 26 OF 27

DIRECTIONS: Given access to standard oxyacetylene safety and welding equipment, tools, 16 gauge mild steel plates and a mild steel filler rod. Obtain 4 pieces of 16 gauge x 2" x 8" mild steel. You will tackweld to form two tee joints. Weld the two tee joints on one side only. The tee fillet weld should be placed correctly on both plates, have proper contour, fuse to both plates and have no undercut. The welds must also pass the bend test. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were plates cleaned of all rust and oil before setting up to weld?....................		
2. Was torch adjusted for a neutral flame?....................		
3. Were plates positioned to form a 90° angle when tackwelding?....................		
4. Were tackwelds in specified locations?....................		
5. Was there adequate fusion to both plates?....................		
6. Was the weld properly placed on both plates?....................		
7. Was there a complete absence of undercut?....................		
8. Was the weld test completed and passed?....................		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained
☐ Not attained

EVALUATOR

DEPT.

PROG.

DUTY

TASK

DEPT.

PROG.

Instructional Resources

Texts

Griffin, Ivan H., Roden, Edward M., and Briggs, Charles W., Basic Oxyacetylene Welding, Delmar Publishers, New York, 1977.

---- -, PAT Workbook, Hobart School of Welding Technology, Troy, Ohio, 1975.

Audivisual

Beseler Cue/See Filmstrip System, Charles Beseler Company, Florham Park, New Jersey, 1977.

KNOWLEDGE TEST FOR ☐ ☐☐

duty task number

PAGE ______ OF ______

DUTY | TASK | DEPT. | PROG.

TASK:

Tack Thin Gauge Plates and Make Butt Welds

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet put T if the item is True and F if the item is False.

DO NOT MARK ON THIS TEST!

1. When tackwelding plates for a butt weld, you must space the plates more on the end opposite where you will place the first tack.

2. For 8" long plates, two tackwelds are enough.

3. You should have complete penetration on a butt weld in a light gauge plate.

4. A "carburizing" flame is used to weld mild steel.

5. Complete penetration is obtained when the weld bead is approximately six times as wide as the thickness of the plate.

6. To completely fuse both sides of the weld joint, the torch tip must be pointed directly into the joint.

Tack Thin Gauge Plates and Make Butt Welds
Answer Key

1. T

2. F

3. T

4. F

5. T

6. T

KNOWLEDGE TEST FOR ☐ ☐☐ PAGE ______ OF ______
duty task number

ASK: Tack Thin Gauge Plates and Make Tee Fillet Welds

DIRECTIONS: The items below are True-False. On the separate Answer Sheet, put T if the item is True and F if the item is False.

DO NOT MARK ON THIS TEST!

1. Undercutting is a particular problem with the tee fillet weld joint.
2. The top of the molten puddle should be slightly ahead of the bottom.
3. Tackwelding the plates at each end is sufficient.
4. The welding rod should be added near the top of the puddle.
5. The upper plate will heat more rapidly than the lower one.
6. The weld bead should cover equal amounts of each plate.
7. More heat is required to weld the second side of the weld joint than the first side.

Tack Thin Gauge Plates and Make Tee Fillet Welds
Answer Key

1. T
2. T
3. F
4. T
5. T
6. T
7. T

KNOWLEDGE TEST FOR ☐ ☐☐ PAGE ______ OF ______

duty task number

DUTY

TASK

DEPT.

PROG.

TASK Tack Thin Gauge Plates and Make Outside Corner Welds

DIRECTIONS

The items below are True-False. On the separate Answer Sheet, put T if the item is True and F if the item is False.

DO NOT MARK ON THIS TEST!

1. When tackwelding an outside corner joint, the plates should be overlapped.

2. The welding flame should be held at a 45° to 60° angle to the weld.

3. When welding mild steel with a neutral flame, very few sparks indicate a lack of penetration.

4. One tack on each end of an outside corner joint is sufficient.

5. A correctly made outside corner weld is as strong as the base metal.

Tack Thin Gauge Plates and Make Outside Corner Welds
Answer Key

1. F
2. T
3. F
4. F
5. T

KNOWLEDGE TEST FOR ☐ ☐☐ PAGE________ OF________

duty task number

DUTY
TASK
DEPT.
PROG.

SK: Tack Thin Gauge Plates and Make Lap Welds.

IRECTIONS:

The items below are True-False. On the separate Answer Sheet, put T if the item is True and F if the item is False.

DO NOT MARK ON THIS TEST!

1. The proper distance to overlap the plates should be no more than 1".

2. Tackwelding the plates at each end is sufficient.

3. If the plates are not tightly together, the top edge will melt back faster.

4. When making a lap weld, the flame should be directed more at the bottom plate.

5. The welding rod should be held away from the top edge and more toward the bottom plate.

6. Proper fusion of both plates will allow the weld to be bent to a "T-shape" without cracking.

7. The torch and weld rod angles are less critical on this joint than on previous joints.

Tack Thin Gauge Plates and Make Lap Welds.
Answer Key

1. T
2. F
3. T
4. T
5. F
6. T
7. F

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 5 PERFORMING COMBINATION WELDING SKILLS

TASK: 0 1 Repair Products from Ferrous/Nonferrous Metals

PURPOSE:

As a welder, you may be required to perform weld repair operations on equipment. This learning guide will help you attain the necessary skills to perform this job.

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY
TASK
PREREQ
DEPT.
PROG.
REVISED

DUTY | TASK | DEPT | PROG

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: access to a blueprint, sketch, Instruction Sheet, tools, and materials.

YOU WILL: repair products from ferrous/nonferrous metals.

HOW WELL: Your performance will be assessed by your instructor using the Performance Test.

ENABLING OBJECTIVES:

1. Layout, mark, and cut.
2. Assemble and weld.

Enabling objective

Layout, mark, and cut.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify the steps in laying out, marking and cutting various parts.	1. Blueprint, sketch, or Instruction Sheet
2. Layout, mark, and cut parts by following the procedure outlined in Resource No. 1. Have your instructor check your work.	2. a. Blueprint, sketch, or Instruction Sheet b. Tools c. Metal
3. Evaluate your work by completing the Self-Check.	3. Self-Check enclosed.
4. Go on to Enabling Objective No. 2.	

SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 5 OF 8

DUTY

TASK

EN OBJ

DEPT.

PROG.

DIRECTIONS: Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Did all parts of the assembly measure within the tolerances shown by the blueprint, sketch, Instruction Sheet?......................		
2. Were angle cuts (if any) cut to the degrees shown by blueprint, sketch or Instruction Sheet?......		
3. Were all parts made from size and type of material shown by blueprint, sketch or Instruction Sheet?..		
4. Were the number of pieces of each part cut as shown by blueprint, sketch or Instruction Sheet?.......		
5. Were all of the parts needed for the assembly cut?..		

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1

number

PAGE 6 OF 8

DUTY

TASK

EN. OBJ

DEPT

PROG.

Enabling objective

Assemble and weld.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify the steps in assembling and welding all parts.	1. Blueprint, sketch, or Instruction Sheet.
2. Assemble and weld all parts by following the procedure outlined in Resource No. 2. Have your instructor check your work.	2. a. Blueprint, sketch or Instruction Sheet b. Tools c. Metal
3. When you think you can perform this task, take the Performance Test.	3. Performance Test.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 7 OF 8

DIRECTIONS:

Given access to a blueprint, sketch or Instruction Sheet, you will repair products from ferrous/nonferrous metals. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Did the overall dimensions fall within the tolerances shown by the blueprint, sketch, or Instruction Sheet?		
2. Was the final assembly square, level, etc. as required by the blueprint, sketch or Instruction Sheet?		
3. Were all welds made in accordance with blueprint, sketch, or Instruction Sheet?		
4. Was all slag and weld splatter removed from the finished assembly?		
5. Were the welds ground flush where required?		
6. Were all critical dimensions within tolerance?		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained
☐ Not attained

EVALUATOR

DEPT.

PROG.

LIST OF RESOURCES, MATERIALS, AND EQUIPMENT PAGE 8 OF 8

DUTY

TASK

DEPT.

PROG.

No additional resources required.

7

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 4 FABRICATING PIPE JOINTS

TASK: 0 2 Set-up and Weld Pipe Joints

PURPOSE:

Pipe welding is considered to be one of the more difficult duties in the field of welding. This learning guide will help you attain the skills needed to become competent in tack-welding and welding pipe.

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY
TASK
PREREQ
DEPT.
PROG.
REVISED

THE SCHOOL BOARD OF PALM BEACH COUNTY

DEPARTMENT OF VOCATIONAL-TECHNICAL EDUCATION

North Technical Education Center
7071 Garden Road
Riviera Beach, Florida 33404

South Technical Education Center
1300 S. W. 30th Avenue
Boynton Beach, Florida 33435

West Technical Education Center
2625 State Road 715
Belle Glade, Florida 33430

E. Miles Bacon, Director of Vocational-Technical Education

Wilma McCarty, Curriculum and Staff Development Specialist

THIS STUDENT LEARNING GUIDE WAS DEVELOPED BY:

This student learning guide was adopted from the Decentralized Welding Project, Florida Department of Education by:

Vince Repper, Welding Instructor
North Technical Education Center

Jim Schmidt, Welding Instructor
South Technical Education Center

Joe Smith, Welding Instructor
West Technical Education Center

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DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:

(include condition, performance, and standard)

GIVEN: access to equipment, tools, pipe, and work station.

YOU WILL: tackweld and weld various pipe joints.

HOW WELL: You must successfully complete the Knowledge Test. Your performance will be assessed by your instructor using the Performance Test on page 6, 8, 10, 12, and 18.

ENABLING OBJECTIVES:

1. Identify standards and tests for pipe welding.
2. Tackweld and weld rolling butt welds on horizontal pipe.
3. Tackweld and weld fixed position welds on horizontal pipe: vertical up and down.
4. Tackweld and weld fixed position welds on vertical pipe.
5. Tackweld and weld a tee joint on pipe.
6. Tackweld and weld a 90° elbow.
7. Tackweld and weld a "Y" header.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number

PAGE 4 OF 19

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Enabling objective:

Identifiy standards and tests for pipe welding.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify standards and tests for pipe welding.	1. PAT Workbook - Topic 4, pages 17 - 21. or Text: Pipe Welding Techniques Units 4 - 5, pages 11 - 27.
2. When you think you can attain this enabling objective, take the Knowledge Test for Enabling Objective No. 1.	2. Knowledge Test for Enabling Objective No. 1.
3. When you successfully complete the Knowledge Test, go on to Enabling Objective No. 2.	

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 5 OF 19

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Tackweld and weld rolling butt welds on horizontal pipe.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine how to bevel, tackweld and weld a rolling butt weld on horizontal pipe.	*PAT Workbook* - Topic 5, pages 22 - 25. or Text: *Pipe Welding Techniques*, Unit 11, pages 53 - 58.
2. Bevel, tackweld, and weld rolling butt welds on horizontal pipe by following the steps in Resource No. 1.	2. a. Equipment b. Tools c. Pipe d. Work station
3. Have instructor check your work.	3. Instructor
4. When you are *sure* you can perform this task, take the Performance Test.	4. Performance Test for Enabling Objective No. 2.
5. After performing this Enabling Objective with 100% competency, go on to Enabling Objective No. 3.	

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 6 OF 19

DIRECTIONS:

Given access to equipment, tools, pipe, and a work station, you will bevel, tackweld and weld a rolling butt weld on horizontal pipe. You will be evaluated for attainment of this task, based upon the item listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Was each piece of pipe beveled approximately 30° leaving a 1/16" to 1/8" flat at the root face?...............		
2. Were the sections of pipe spaced approximately 3/32" when tackwelding?		
3. Were the two sections straight after tackwelding?............		
4. Was the root pass started off center, deposited toward the top and stopped beyond center?................		
5. Was the crater cleaned and pipe rotated before continuing the root pass?..		
6. Was the procedure for depositing the second pass the same as No. 4 and No. 5 above?................................		
7. Was there 100% penetration on the finished weld?............		
8. Was the finished weld free of undercut and slag entrapment?..		
9. Was the weld face slightly convex and higher than the pipe surfaces?..		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE

3
number

PAGE 7 OF 19

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Enabling objective

Tackweld and weld fixed position welds on horizontal pipe: vertical up and down.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine how to bevel, tackweld and weld a vertical up and down weld on fixed horizontal pipe.	1. PAT Workbook - Topic 7, pages 30 - 37. or Text: Pipe Welding Techniques, Units 12 - 13, pages 59 - 67.
2. Bevel, tackweld and weld both vertical up and vertical down welds on fixed horizontal pipe by following the steps in Resource No. 1.	2. a. Equipment b. Tools c. Pipe d. Work station
3. Have instructor check your work.	3. Instructor
4. When you are sure you can perform this task, take the Performance Test.	4. Performance Test for Enabling Objective No. 3.
5. After performing this Enabling Objective with 100% competency, go on to Enabling Objective No. 4.	

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 8 OF 19

DIRECTIONS:

Given access to equipment, tools, pipe, and a work station, you will bevel, tackweld and weld both a vertical up and vertical down weld on fixed horizontal pipe. You will be evaluated for attainment of this task, based upon the item listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Was each piece of pipe beveled approximately 30° leaving a 1/16" to 1/8" flat at the root face?		
2. Were the sections of pipe spaced approximately 3/32" when tackwelding?		
3. Were the two sections straight after tackwelding?		
4. On the vertical up weld, was the first section of the root pass started at 5 o'clock and deposited toward 6 o'clock and beyond?		
5. Were the craters cleaned each time when stopping and restarting the weld beads?		
6. Was the second pass deposited using the same procedure as No. 4 and No. 5 above?		
7. On the vertical down weld, was the first section of the root pass started at 1 o'clock or 11 o'clock, deposited toward 12 o'clock and beyond?		
8. Were the finished weld free of undercut and slag entrapment?		
9. Were the weld faces convex and slightly above the pipe surfaces?		
10. Was there 100% penetration on the welds?		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 4 number

PAGE 9 OF 19

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Enabling objective:

Tackweld and weld fixed position welds on vertical pipe.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine how to bevel, tackweld and weld fixed position welds on vertical pipe.	1. PAT Workbook - Topic 9, pages 40 - 44. or Text: Pipe Welding Techniques, Unit 14, pages 68 - 71.
2. Bevel, tackweld and weld fixed position welds on vertical pipe by following the steps in Resource No. 1.	2. a. Equipment b. Tools c. Pipe d. Work Station
3. Have instructor check your work.	3. Instructor
4. When you are sure you can perform this task, take the Performance Test.	4. Performance Test for Enabling Objective No 4.
5. After performing this Enabling Objective with 100% competency, go on to Enabling Objetive No 5.	

PERFORMANCE TEST FOR ☐ ☐☐
duty task number

PAGE 10 OF 19

DIRECTIONS:

Given access to equipment, tools, pipe and work station, you will bevel, tackweld and weld a fixed position butt weld on vertical pipe. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were the pipe sections beveled approximately 30^{o} on each piece leaving a 1/16" to 1/18" flat at the root face?..........		
2. Were the sections straight after tackwelding leaving approximately 3/32" space or gap at the root?..........		
3. Was there 100% penetration on the root pass?..........		
4. Was the finished weld free of undercut?..........		
5. Was the finished weld face slightly convex with a minimum of sag?..........		

9

DUTY
TASK
ATTEMPT
STUDENT
DATE
☐ Attained
☐ Not attained
EVALUATOR
DEPT.
PROG.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 5 number

PAGE 11 OF 19

Enabling objective:

Tackweld and weld a tee joint on pipe.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine how to tackweld and weld a tee joint on pipe.	1. PAT Workbook - Topic 7, pages 30 - 37. or Text: Pipe Welding Techniques, Unit 17, pages 79 - 83.
2. Tackweld and weld a tee joint on pipe by following the steps in Resource No. 1.	2. a. Equipment b. Tools c. Prepared pieces of pipe from Task I-01, Enabling Objective No. 3. d. Work station
3. Have instructor check your work.	3. Instructor
4. When you are sure you can perform this task, take the Performance Test.	4. Performance Test for Enabling Objective No. 5.
5. After performing this Enabling Objective with 100% competency, go on to Enabling Objective No. 6.	

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 5

number

PAGE 11 OF 19

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Tackweld and weld a tee joint on pipe.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine how to tackweld and weld a tee joint on pipe.	1. PAT Workbook - Topic 7, pages 30 - 37. or Text: Pipe Welding Techniques, Unit 17, pages 79 - 83.
2. Tackweld and weld a tee joint on pipe by following the steps in Resource No. 1.	2. a. Equipment b. Tools c. Prepared pieces of pipe from Task I-01, Enabling Objective No. 3. d. Work station
3. Have instructor check your work.	3. Instructor
4. When you are sure you can perform this task, take the Performance Test.	4. Performance Test for Enabling Objective No. 5.
5. After performing this Enabling Objective with 100% competency, go on to Enabling Objective No. 6.	

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 12 OF 19

DIRECTIONS:

Given access to equipment, tools, pipe and work station, you will cut, bevel, tackweld and weld a fixed position tee joint with the branch connection vertical. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were both the branch and header pipes centerpunched to help in aligning when tackwelding?		
2. Was either the branch or header pipe beveled before tackwelding?		
3. Were the weld beads started at the side of the header centerline (12:30 position) when viewed down from the branch?		
4. Was there 100% penetration on the root pass?		
5. Was the finished weld free of undercut?		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 6 number PAGE 13 OF 19

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Tackweld and weld a 90° elbow.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine how to tackweld and weld a 90° elbow.	1. Instruction Sheet enclosed, Tackwelding and Welding a 90° Elbow
2. Tackweld and weld a 90° elbow by following the steps in Resource No. 1.	2. a. Equipment b. Tools c. Prepared pieces of pipe from Task I-01, Enabling Objective No. 2.
3. Have instructor check your work.	3. Instructor
4. When you are sure you can perform this task, take the Performance Test.	4. Performance Test for Enabling Objective No. 6.
5. After performing this Enabling Objective with 100% competency, go on to Enabling Objective No. 7.	

Tackwelding and Welding a 90° Elbow

1. Obtain elbow sections from Task I-01, Enabling Objective No. 1.

2. Set-up sections so that centerlines align at a 90° angle. See Figure 1 below.

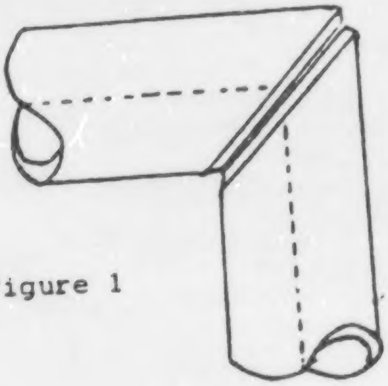

Figure 1

3. Tackweld at points A, B, and C; A first, B second, and C last. See Figure 2A and 2B below. Be sure you leave 3/32" to 1/8" space at root face. Remove all flux from tackwelds.

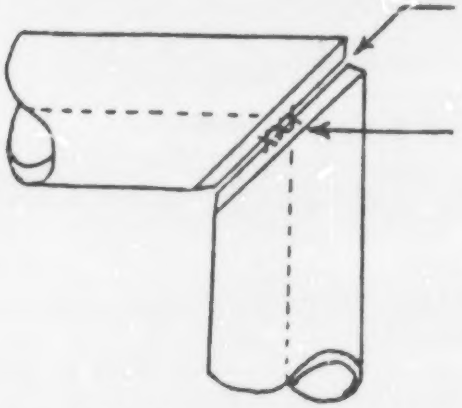

Figure 2A

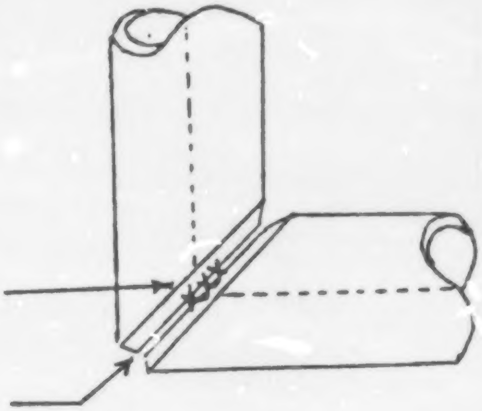

Figure 2B

4. Start weld just past centerline at tackweld A, weld through tackweld A, tackweld C, and just past tackweld B. Remove all flux. Finish root pass by welding from B to A. Remove all flux. Deposit remaining passes by following this same sequence.

Note: Most of the shrinkage and distortion will be at the inside of the 90° area. By following the above welding sequence, you can control it.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 15 OF 19

DIRECTIONS:

Given access to equipment, tools, pipe and work station, you will cut, bevel, tackweld and weld a 90° elbow. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were the elbow sections aligned by their centerlines?.......		
2. Was there 100% penetration on the root pass?.................		
3. Was the finished weld free of undercut?......................		
4. Were the weld beads started near the centerline of the pipe, away from the 90° angles?..........................		
5. Was the elbow square after welding?.........................		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained
☐ Not attained

EVALUATOR

DEPT.

PROG.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 7

number

PAGE 16 OF 19

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Tackweld and weld a "Y" header.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine how to tackweld and weld a "Y" header.	1. Instruction Sheet enclosed, Tackwelding and Welding a "Y" Header
2. Tackweld and weld a "Y" header by following the steps in Resource No. 1.	2. a. Equipment b. Tools c. Prepared pieces of pipe from Task I-01, Enabling Objective No. 4. d. Work station
3. Have instructor check your work.	3. Instructor
4. When you are sure you can perform this task, take the Performance Test.	4. Performance Test for Enabling Objective No. 7.

Tackwelding and Welding a "Y" Header

1. Obtain the sections for a "Y" header from Task I-01, Enabling Objective No. 3.

2. Align pieces to form a "Y" leaving 3/32" to 1/8" gap between all sections.

3. Tackweld at points A-B-C-D-E-F in that sequence. Refer to Figures 1A and 1B below.

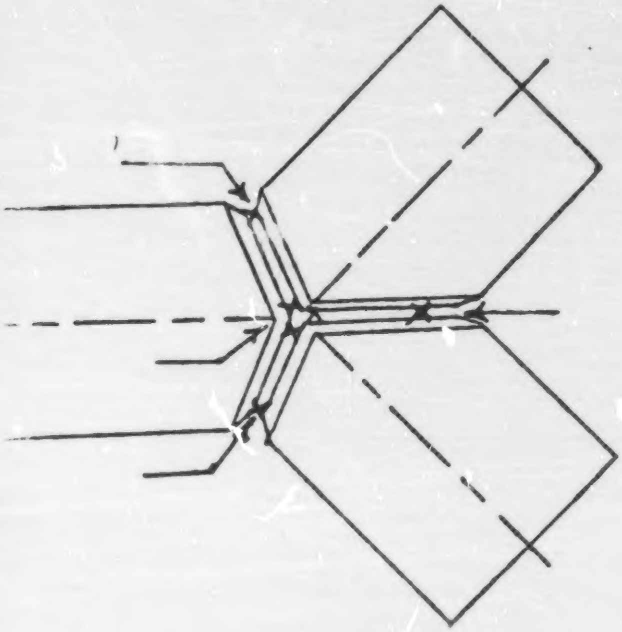

Figure 1A

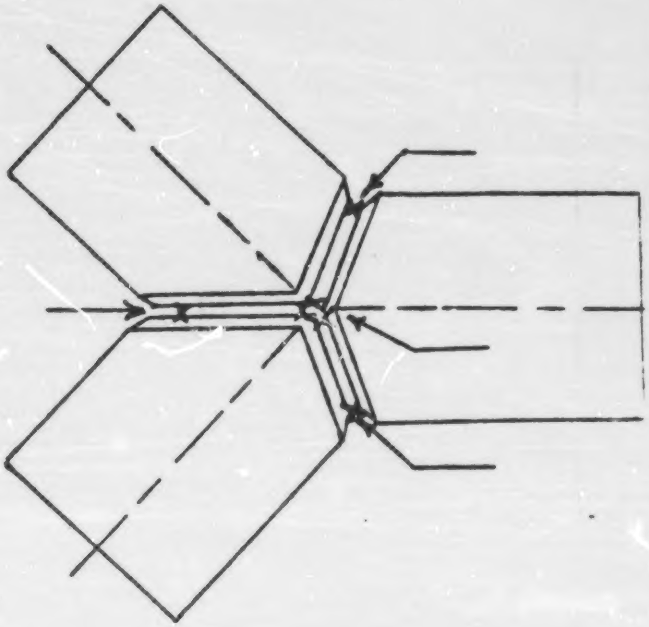

Figure 1B

For Fixed Position Welding

1. Clamp assembly in fixture so that header pipe is in the horizontal position.

2. Start root pass at either 5 or 7 o'clock and weld through 6 o'clock to 11 or 1 o'clock.

3. Remove all flux.

4. Start root pass for leg sections at point A, weld through points E and F to point B.

5. Remove all flux.

6. Complete weld by following the same sequence.

Note: Most of the pull (distortion) will occur in the weld at the leg sections. You can help control it though.

KNOWLEDGE TEST FOR ☐ ☐☐

duty task number

PAGE 1 OF 2

TASK: Set-up and Weld Pipe Joints

DIRECTIONS:

The items below are Multiple Choice. On the separate Answer Sheet, put the letter of the correct answer in the blank to the left of the number of the question.

DUTY

TASK

DEPT.

PROG.

1. Which organization published the most commonly used code for boiler and pressure vessel welding?

   a. American Welding Society (AWS)
   b. American Society of Mechanical Engineers (ASME)
   c. American Petroleum Institute (API)
   d. American National Standards Institute (ANSI)

2. The ASME recommends that the root pass on sections for nuclear power piping be deposited by the:

   a. Oxyacetylene Process (O-A).
   b. Shielded Metal Arc Process (SMAW).
   c. Metal Inert Gas Process (MIG).
   d. Tungsten Inert Gas Process (TIG).

3. According to the ASME code, which test position qualifies the welder for all groove welds?

   a. 1F
   b. 4F
   c. 4G
   d. 6G

4. After bending a specimen, which of the following is not considered to be a test failure?

   a. lack of fusion
   b. small surface defects
   c. slag inclusions
   d. pockets caused by gas

5. When conducting a guided bend test:

   a. use a mild steel specimen.
   b. use a high carbon steel specimen.
   c. bend the specimen 180°.
   d. bend the specimen until it cracks.

6. A specimen is tested in the guided bend test by:

a. bending in a vise.
b. bending with a pipe wrench.
c. bending in a jig.
d. bending around pipe.

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 1 OPERATING GAS WELDING EQUIPMENT

TASK: 0 9 Cut Carbon Steel Using Oxy-fuel Equipment

PURPOSE:

It is necessary that a welder become competent in the knowledge and skill needed to make good, clean cuts in a carbon steel plate using the oxy-fuel acetylene cutting torch.

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY
TASK
PREREQ.
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REVISED

THE SCHOOL BOARD OF PALM BEACH COUNTY

DEPARTMENT OF VOCATIONAL-TECHNICAL EDUCATION

North Technical Education Center
7071 Garden Road
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South Technical Education Center
1300 S. W. 30th Avenue
Boynton Beach, Florida 33435

West Technical Education Center
2625 State Road 715
Belle Glade, Florida 33430

E. Miles Bacon, Director of Vocational-Technical Education

Wilma McCarty, Curriculum and Staff Development Specialist

THIS STUDENT LEARNING GUIDE WAS DEVELOPED BY:

This student learning guide was adopted from the Decentralized Welding Project, Florida Department of Education by:

Vince Repper, Welding Instructor
North Technical Education Center

Jim Schmidt, Welding Instructor
South Technical Education Center

Joe Smith, Welding Instructor
West Technical Education Center

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DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: access to a portable oxyacetylene cutting outfit, hand torch and tip, safety equipment, tools, metal plate, and a work station.

YOU WILL: cut carbon steel using oxy-fuel equipment.

HOW WELL:

You must successfully complete the Knowledge Test. Your performance will be assessed by your instructor using the Performance Test on page 15.

ENABLING OBJECTIVES:

1. Define the terms in this Learning Guide.
2. Select a portable oxyacetylene cutting outfit, safety equipment, tools and metal plate.
3. Prepare a metal plate for cutting.
4. Cut a mild steel plate with oxyacetylene equipment.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number

PAGE 4 OF 16

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Define the terms in this Learning Guide.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to define the welding terms used in the Learning Guide.	1. Instruction Sheet enclosed, Welding Terms
2. Evaluate your knowledge by completing the Self-Check.	2. Self-Check enclosed
3. Go on to Enabling Objective No. 2.	

Welding Terms

1. Carbon steel - a broad range of material containing: carbon 1.7% maximum, manganese 1.65% maximum, and silicon 0.60% maximum.

2. Mild steel - steel containing less than 30% carbon.

3. Draglines - lines left in the edge of metal by the cutting process.

4. Soap stone - a device used for marking metal.

5. Ball peen hammer - a hammer that has the head rounded on one end and is flat on the other end.

6. Mushroomed - a jagged or irregular edge caused by hammering.

7. Center punch - a hardened metal rod designed to punch and mark metal.

8. Kerf -the amount of metal burned out when you make the cut.

SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 6 OF 16

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your knowledge by matching the items below on a separate sheet of paper.

1. A jagged or irregular edge caused by hammering.
2. Steel that contains less than .30% carbon.
3. The amount of metal burned out when you make a cut.
4. A device used for marking on metal.
5. Lines left in the edge of metal when being cut.
6. A hardened metal rod used for punch marking metals.
7. A tool which has the head rounded on one end and is flat on the other end.

a. draglines

b. soapstone

c. centerpunch

d. ball peen hammer

e. kerf

f. mushroomed

g. mild steel

h. plate

i. adjustable

Now check your answers with the Answer Key.

1. f
2. g
3. e
4. b
5. a
6. c
7. d

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2

number

PAGE 8 OF 16

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Select a portable oxyacetylene cutting outfit, safety equipment, tools, and metal plate.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify an oxyacetylene cutting outfit.	1. PAT Workbook, Topic 3, pages 13 and 43.
2. Read Resource No. 2 to locate a cutting outfit, safety equipment, tools, and metal plate.	2. Instruction Sheet enclosed, Procedure for Selecting a Cutting Outfit, Safety Equipment, Tools, and Metal Plate
3. Assemble all equipment and materials at your work station following the procedure outlined in Resource No. 2.	3. a. Equipment b. Materials
4. Evaluate your work by completing the Self-Check. Have your instructor check your work.	4. Self-Check enclosed.
5. Go on to Enabling Objective No. 3.	

Procedure for Selecting a Cutting Outfit, Safety Equipment, Tools, and Metal Plate

1. Obtain the following items:

   a. oxyaceatylene goggles

   b. gloves

   c. striker

   d. soapstone

2. Obtain the following items from the storage area:

   a. one portable oxyacetylene cutting outfit, complete with hand cutting torch and tip.

CAUTION: BE SURE THE CYLINDERS ARE SECURELY FASTENED TO A PORTABLE CART BEFORE ATTEMPTING TO MOVE THE CART!

3. Obtain the following items from the metal storage area:

   a. one piece of 3/8" x 12" x 12" mild steel plate

   b. one piece of 1/2" x 12" x 12" mild steel plate

4. Obtain the following items from the tool room:

   a. one 12" adjustable wrench

   b. one ball peen hammer

   c. one center punch

   d. one straightedge

5. Assemble all equipment and materials at your work station.

SELF-CHECK FOR ENABLING OBJECTIVE 2 number

PAGE 10 OF 16

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.
All items should receive a "YES" response.

	YES	NO
1. Were oxygen and acetylene fittings tight?.........	____	____
2. Were line pressure adjusting screws backed out so they could turn freely?.......................	____	____
3. Was protective equipment in good condition?.......	____	____
4. Were metal pieces of thickness indicated (one piece 3/8" thick and one piece 1/2" thick)?......	____	____
5. Were tools in working condition?.................	____	____

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 3

number

PAGE 11 OF 16

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Prepare a metal plate for cutting.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify the steps in preparing metal plates for cutting.	1. Instruction Sheet enclosed, Preparing Metal Plates for Cutting
2. Prepare the two plates for cutting following the procedure outlined in Resource No. 1.	2. a. Equipment b. Tools
3. Evaluate your work by completing the Self-Check. Have your instructor check your work.	3. Self-Check enclosed.
4. Go on to Enabling Objective No. 4.	

Preparing Metal Plates for Cutting

1. Using the straightedge and soapstone, mark a line 1/2" from one edge of the 3/8" thick steel plate. Make the line all the way across the plate.

NOTE: IF STEEL PLATE IS RUSTY OR OILY, WIRE BRUSH PLATE BRUSH PLATE BEFORE MARKING.

2. Measure 2" from the line you have just made and mark another line across the plate.

3. Continue marking lines at 2" intervals until you reach the opposite side.

4. Using the center punch and hammer, make center punch marks at approximately 1/2" intervals along each soapstone mark.

   NOTE: SOAPSTONE MARKS WILL BURN OFF BUT CENTER PUNCH MARKS WILL NOT!

5. Layout, mark and center punch the 1/2" thick steel plate in the same manner.

6. Position the 3/8" thick steel plate on the table so that the first center punched line is beyond the edge of the table.

SELF-CHECK FOR ENABLING OBJECTIVE 3 number PAGE 13 OF 16

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.
All items should receive a "YES" response.

	YES	NO
1. Were center punch marks deep enough to be visible when cutting?..................		
2. Were center punch mark lines approximately 2" apart across plates?.......................		
3. Were both plates center punched?...............		
4. Was the 3/8" thick plate positioned so that the first center punch marked line was beyond the table?....................................		

If you received a "NO" response for any item, go back and repeat one or more of the learning activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 4 number PAGE 14 OF 16

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Enabling objective

Cut a mild steel plate with oxyacetylene equipment.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Light a torch and adjust for a neutral flame by following the procedure outlined in Resource No. 1.	1. Module: "Vocational Trade and Industrial Education - Welding", Section D, pages 5D-20D.
2. Read Resource No. 2 to identify the procedure for cutting mild steel.	2. a. PAT Workbook, Topic 15. b. Beseler Cue/See, Topic 15. or Text: Basic Oxyacetylene Welding, pages 23-33.
3. Practice making cuts in both the 3/8 and 1/2" thick plates by following the procedure outlined in Resource No. 2.	3. Knowledge Test.
4. When you think you can attain this task, take the Knowledge Test.	4. Performance Test.
5. When you successfully complete the Knowledge Test, take the Performance Test.	

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 15 OF 16

DIRECTIONS:

Given access to a portable oxyacetylene cutting outfit, hand torch and tip, safety equipment, tools, metal plate and a work station, you will cut carbon steel using oxy-fuel equipment.

You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were all fittings checked to be sure they were tight?		
2. Were both line pressure adjusting screws backed out?		
3. Were plates of correct thickness?		
4. Were plates wire brushed if necessary		
5. Were marks started 1/2" from one edge of the plate?		
6. Were marks spaced approximately 2" apart?		
7. Were the preheat cones adjusted for a neutral flame?		
8. Was the torch held so that the preheat flames were approximately 1/8" above the plate?		
9. Was the torch tip held 90° to the line of the cut?		
10. Was the plate travelled across without losing the cut?		
11. Were draglines of the cuts straight and even?		
12. Was the top edge of cut square and not rounded over?		
13. Was there a minimum of slag on the bottom edge?		
14. Were six pieces cut uniform in width?		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

Instructional Resources

Texts

Griffin, Ivan H., Roden, Howard M., and Briggs, Charles W.,

Basic Oxyacetylene Welding, Delmar Publishers, New York 1977.

------, PAT Workbook, Hobart School of Welding Technology

Troy, Ohio, 1975.

State Department of Vocational and Technical Education, Module: "Vocational Trade and Industrial Education -Welding," Oklahoma State Board of Vocational and Technical Education, Stillwater, Oklahoma, 1974.

Audiovisual

Beseler Cue/See Filstrip System, Charles Beseler Company, Florham

Park, New Jersey, 1977.

KNOWLEDGE TEST FOR ☐ ☐☐

duty task number

PAGE 1 OF 2

DUTY
TASK
DEPT.
PROG.

TASK: Cut Carbon Steel Using Oxy-fuel Equipment

DIRECTIONS:

Evaluate your knowledge by answering the items below on a separate Answer Sheet.

DO NOT MARK ON THIS TEST!

The items below are Multiple Choice. On the separate Answer Sheet, put the letter of the correct answer on the blank to the left of the number of the question.

1. The proper oxygen line pressure setting is:

   a. 3 to 5 psi.
   b. 5 to 8 psi.
   c. 10 to 15 psi.
   d. 15 to 20 psi.

2. The maximum line pressure for acetylene is:

   a. 5 psi
   b. 15 psi.
   c. 20 psi.
   d. 30 psi.

The items below are True-False. On the separate Answwer Sheet, put T if the item is True and F if the item is False.

1. Soap stone marks may burn off when cutting.

2. When preheating the metal, the flame should touch the metal plate.

3. If the cutting action stops as you are traveling across the plate, it indicates you are moving too fast.

4. The torch must be held at a 90° angle with the cut to make a straight cut.

5. The cutting process will change the chemical composition of the metal.

6. Both line pressure adjusting screws should be backed out so they turn freely.

KNOWLEDGE TEST FOR ☐ ☐☐

CONTINUED duty task number PAGE 2 OF 2

DUTY

TASK

DEPT.

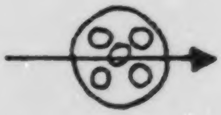
PROG.

7. Soap stone marks are easier to see when cutting than center punch marks.

8. "Kerf" is an opening, slot, or cut made by the flame in the metal.

9. Draglines is the metal that sticks to the bottom of the plate being cut.

10. The end of the cutting tip installed for a straight cut looks like this:



17

2

Answer Key

Multiple Choise

1. b
2. c

True-False questions

1. T
2. F
3. T
4. T
5. F
6. T
7. F
8. T
9. F
10. F

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 1 OPERATING GAS WELDING EQUIPMENT

TASK: 0 7 Lead Solder Ferrous and Nonferrous Metal

PURPOSE:

The soldering process has many variations, and is widely used in electrical and sheet metal work. This Learning Guide will help you to understand the principles of soft soldering.

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DUTY
TASK
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DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:

(Include condition, performance, and standard)

GIVEN: access to a work station, equipment, tools, and materials,

YOU WILL: lead solder ferrous and nonferrous metal.

HOW WELL: You must successfully complete the Knowledge Test. Your performance will be assessed by your instructor using the Performance Standards on page 12.

ENABLING OBJECTIVES:

1. Identify steps in lead soldering ferrous and nonferrous metal.
2. Assemble equipment, tools and materials needed for this task.
3. Practice lead soldering ferrous and nonferrous metal.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1

number

Enabling objective:

Identify steps in lead soldering ferrous and nonferrous metals.

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to define welding terms used in this task.	1. Instruction Sheet enclosed, Welding Terms
2. Read Resource No. 2 to identify steps in lead soldering ferrous and nonferrous metal.	2. Text: Modern Welding, Chapter 15-"Soldering".
3. Evaluate your knowledge using the Self-Check.	3. Self-Check enclosed.
4. Go on to Enabling Objective No. 2.	

Welding Terms

Soldering - is a means of fastening metals by adhering them with a very low temperature alloy.

Alloy - is an intimate mixture of two or more metals.

Capillary Action - is the property of a liquid to move into small spaces, if it has the ability to "wet" the surfaces.

Flux - is a chemical used to promote fusion of metals during the welding process.

Tinning - is a coating of the soldering metal given to the metal to be soldered.

SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 6 OF 13

DUTY

TASK

EN. OBJ

DEPT.

PROG.

DIRECTIONS:

Evaluate your knowledge by matching the items below on a separate sheet of paper.

1. A chemical used to promote fusion of metals during the welding process.
2. A means of fastening metals by adhering them with a low temperature alloy.
3. The property of a liquid to move into small spaces if it has the ability to "wet" the surfaces.
4. A coating of the soldering metal given to the metal to be soldered.
5. An intimate mixture of two or more metals.

a. soldering

b. capillary action

c. flux

d. tinning

e. alloy

Now check your answers with the Answer Key

SELF-CHECK FOR ENABLING OBJECTIVE 1 number
ANSWER KEY

1. c
2. a
3. b
4. d
5. e

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2

number

PAGE 8 OF 13

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Assemble equipment, tools and materials needed for this task.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify equipment, tools, and materials and their location.	1. Instruction Sheet enclosed, Needed Equipment, Tools and Materials
2. Assemble equipment, tools and materials at your work station by following the procedure in Resource No. 1	2. a. Equipment b. Tools c. Materials d. Work station
3. Have instructor check your work station.	3. Instructor
4. When you think you can attain this task, take Knowledge Test.	4. Knowledge Test
5. Go on to Enabling Objective No. 3.	

Needed Equipment, Tools and Materials

1. Obtain:

    a. standard oxyacetylene protective equipment

2. Obtain:

    a. acid core solder

    b. flux

    c. steel wool

    d. block of sal amoniac

    e. sheet metal and copper strips (2" x 4")

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 3 number

PAGE 10 OF 13

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Practice lead soldering ferrous and nonferrous metal.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. See instructor for your job of lead soldering ferrous and non-ferrous metal.	1. Instructor
2. Practice soldering sheet metal and copper strips.	2. a.Tools b.Equipment c.Materials
3. Evaluate your work using the Self-Check.	3. Self-Check enclosed.
4. When you think you can perform this task, take the Performance Test.	4. Peformance Test

SELF-CHECK FOR ENABLING OBJECTIVE 3

number

PAGE 11 OF 13

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Were the surfaces to be soldered thoroughly cleaned?.................................		
2. Was the solder melted by the metal?........		
3. Was any excess molten solder wiped away with a clean cloth?........................		
4. Was the torch held at a safe distance to avoid over heating?....................		
5. Was the workpiece properly supported?......		
6. Was the finished joint cleaned with hot water and baking soda to neutralize the acid action of the flux?.................		
7. Was the joint free of such defects as poor adhesion, incomplete soldering, too much solder, overheating, and dirt inclusion?		

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 12 OF 13

DIRECTIONS:

Given access to metal, tools and equipment, you will prepare metal and solder two strips of copper and two strips of sheet metal to form lap joints. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were the surfaces to be soldered thoroughly cleaned?..		
2. Was the solder melted by the metal?....................		
3. Was any excess molten solder wiped away with a clean cloth?....................................		
4. Was the torch held at a safe distance to avoid overheating?..		
5. Was the workpiece properly supported?................		
6. Was the finished joint cleaned with hot water and baking soda to neutralize the acid action of the flux?..		
7. Was the joint free of such defects as poor adhesion, incomplete soldering, too much solder, overheating, and dirt inclusion?....................................		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

DUTY

TASK

DEPT.

PROG.

Instructional Resource

Text

Althouse, Turnquist, and Bowditch, *Modern Welding*, Goodheart-Willcox Co., South Holland, Illinois, 1970.

KNOWLEDGE TEST FOR ☐ ☐☐
duty task number

PAGE 1 OF 1

DUTY
TASK
DEPT.
PROG.

TASK: Lead Solder Ferrous and Nonferrous metal

DIRECTIONS: Evaluate your knowledge by answering True or False to the items below on a separate sheet of paper. Circle T if the item is True and F if the item is False.

DO NOT MARK ON THIS TEST!

1. A soldering copper is often referred to as a soldering iron.
2. The process of cleaning and solder coating the soldering copper is called "tinning".
3. When using the correct type of flux, it is not necessary to remove oxides, grease, and dirt from the metal to be soldered.
4. The main flux container should be sealed when not in use.
5. Certain solder joints must be soldered using a noncorrosive flux.
6. When soldering iron and copper, sal ammoniac (ammonium cloride) is an ineffective flux.
7. When soldering, adhering a thin layer or film of solder to a metal surface is called plating.
8. The joint could be contaminated if excess molten solder is wiped away with a cloth.
9. To solder cast iron, it must first be filed, machine blasted, or shot blasted to remove the oxide skin.
10. The parts of a joint should be firmly supported during the soldering operation.

Answer Key

1. T
2. T
3. F
4. T
5. T
6. F
7. F
8. F
9. T
10. T

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

DUTY

TASK

PREREQ.

DEPT.

PROG.

REVISED

PROGRAM: WELDING

DUTY: 1 OPERATING GAS WELDING EQUIPMENT

TASK: 0 6 Silver Braze Copper Pipe Joints

PURPOSE:

Silver brazing is a very useful and desirable method of joining metal parts. A knowledge of its characteristics and uses will greatly increase the scope of the welder.

PLEASE DO NOT WRITE IN LEARNING GUIDE

OBJECTIVES

DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:
(Include condition, performance,
and standard)

GIVEN: access to a work station, standard oxyacetylene equipment, silver solder and flux, copper strips and copper tubing, hand tools, and emory cloth.

YOU WILL: silver braze copper pipe joints.

HOW WELL: You must successfully complete the Knowledge Test. Your performance will be assessed by you instructor using the Performance Test on page 12.

ENABLING OBJECTIVES:

1. Assemble standard oxyacetylene equipment.
2. Prepare metal for silver brazing.
3. Silver braze copper strips and tubing.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE ☐ number

PAGE 4 OF 14

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Enabling objective

Assamble standard oxyacetylene equipment.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to define the welding terms.	1. Instruction Sheet enclosed, Welding Terms
2. Evaluate your knowledge by completing the Self-Check.	2. Self-Check enclosed.
3. Use Resource No.3 to to identify the necessary equipment.	3. Instruction Sheet enclosed, Selecting Tools and Equipment
4. Assemble all equipment, tools, and materials at your work station by following the procedure outlined in Resource No. 3.	4. a. Equipment b. Tools c. Materials
5. Evaluate your work by completing the Self-Check. Have your instructor check your work.	5. Self-Check enclosed.
6. Go on to Enabling Objective No.2.	

Welding Terms

1. Alloy - an intimate mixture of two or more metals.

2. Brazing - making an adhesion connection with a minimum of alloy which melts above 800° F. and it flows by capillary action between close fitting parts.

3. Silver brazing - low temperature brazing. A typical alloy used in silver brazing containing 80% copper, 15% silver and 5% phosphorous. The melting point of this alloy is well below the melting point of brass or copper, the metals most commonly silver brazed.

4. Soldering - a means of fastening metals together by adhering them with a very low temperature alloy.

5. Flux - a chemical used to promote fusion of metal during the welding process.

6. Welding head - a combination welding tip and mixing chamber. When attached to a torch body it becomes a complete oxyacetylene welding or brazing torch.

7. Emory cloth - an abrasive agent used to clean and polish metal surfaces.

8. Capillary action - the property of a liquid to move into small spaces if it has the ability to "wet" the surface.

SELF-CHECK FOR ENABLING OBJECTIVE ☐

number

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your knowledge by matching the items below on a separate sheet of paper.

1. A chemical used to promote fusion of metals during the welding process.
2. A typical alloy used in this process contains 80% copper, 15% silver, and 5% phosphorous. The melting point of this alloy is at a very low temperature.
3. An abrasive agent used to clean and polish metal surfaces.
4. A means of fastening metals together by adhering them with a very low temperature alloy.
5. An intimate mixture of two or more metals.
6. Making an adhesion connection with a minimum of alloy that melts above 800° F. and it flows by capillary action between close fitting parts.
7. The property of a liquid to move in to small spaces if it has the ability to "wet" the surface.
8. A combination welding tip and mixing chamber that becomes a complete oxyacetylene brazing torch when attached to a torch body.

a. brazing

b. capillary action

c. soldering

d. welding head

e. flux

f. silver brazing

g. alloy

h. emory cloth

i. copper strips

j. metal

Now check your answers with the Answer Key.

1. e
2. f
3. h
4. c
5. g
6. a
7. b
8. d

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

Selecting Tools and Equipment

Using the steps listed below, obtain the following tools, equipment, and materials.

1. Obtain the following:
   a. Standard oxyacetylene protective equipment
2. Obtain the following items from the tool crib:
   a. Emory cloth
   b. 1/16" diameter silver solder
   c. Silver solder flux
   d. W-17 size No. 4 welding head
3. Obtain the following items from the metal storage area:
   a. Four pieces of strip copper 1/16" thick x 1" wide x 6" long
   b. Four pieces of copper tubing

   NOTE: TWO OF THE PIECES MUST FIT INSIDE THE OTHER TWO PIECES.

SELF-CHECK FOR ENABLING OBJECTIVE ☐ number

PAGE 9 OF 14

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by completing the items below on a separate sheet of paper.
All items should receive a "YES" response.

	YES	NO
1. Was standard oxyacetylene protective equipment worn (goggles, gloves, striker, and safety glassses)?....................		
2. Was equipment in safe condition?........		
3. Was 1/16" silver solder used?...........		
4. Was appropriate silver flux used for silver soldering?......................		
5. Was appropriate welding head used?......		
6. Was copper metal selected according to procedure?............................		

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

Enabling objective

Prepare metal for silver brazing.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the procedure for cleaning surfaces for silver brazing.	1. Text: Basic Oxyacetylene Welding, page 88, procedures 1 and 2, page 89, procedures 7 and 8.
2. Evaluate your work by completing the Self-Check. Have your instructor check your work.	2. Self-Check enclosed.
3. Go on to Enabling Objective No. 3.	

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

SELF-CHECK FOR ENABLING OBJECTIVE 2 number

PAGE 11 OF 14

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.
All items should receive a "YES" response.

	YES	NO
1. Were surfaces to be silver brazed cleaned with an emory cloth?........................		
2. Was a thin layer of flux applied to both surfaces of the strips that are to make contact when brazed?.......................		
3. Was flux applied to the inside of the larger diameter tubing and to the inside of the smaller diameter tubing?..................		
4. Was flux applied slightly beyond the areas to be silver brazed?.......................		

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 3

number

PAGE 12 OF 14

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Silver braze copper strips and tubing.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the procedure to silver braze copper.	1. Text: Basic Oxyacetylene Welding, pages 88-89, procedures 4-10.
2. Silver braze two pieces of copper strips and two pieces copper tubing by following the procedure outlined in Resource No. 1.	2. a. Equipment b. Tools c. Materials
3. Test the silver brazed joints. Have your instructor present.	3. a. Text: Basic Oxyacetylene Welding, page 89, procedures 7 and 11.
4. When you think you can attain this task, take the Knowledge Test.	4. Knowledge Test
5. When you successfully complete the Knowledge Test, take the Performance Test.	5. Performance Test

PERFORMANCE TEST FOR ☐ duty | 0 | 6 | task number

PAGE 13 OF 14

DIRECTIONS:

Given access to a work station, standard oxyacetylene equipment, silver solder and flux, copper strips and tubing, hand tools, and emory cloth, you will silver braze copper pipe joints. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Was metal thoroughly cleaned before applying flux?		
2. Was a thin layer of flux applied to all surfaces that will contact each other?		
3. Was the torch adjusted for a 2x or 3x flame?		
4. Was the brazing alloy applied to the joint a short distance from the flame?		
5. Was the flux used as a temperature guide?		
6. Was a small bead formed on the bottom as well as the top of the brazed joint as the silver solder flowed throughout the joint?		
7. Was joint tested by determining if the metal tore before the joint broke?		
8. Was a small bead formed at the end of the inner tube on the joint made with copper tubing?		
9. Was the brazing alloy visible between the two when the tubing joint was sawed into two parts?		
10. Was the brazing alloy only added to one side of the joint?		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

Instructional Resources

Texts

Griffin, Ivan H., Rhoden, Edward M., and Briggs, Charles W., Basic Oxyacetylene Welding, Delmar Publishers, Albany, New York, 1977.

Silver Braze Copper Pipe Joints

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet, put T if the item is True and F if the item is False.

DO NOT MARK ON THIS TEST!

1. When the heat is first applied, the flux dries and turns black.
2. When the temperature of the metal approaches 1300° F. the flux will become fluid and flow over the surfaces.
3. Proper joint spacing is not important when silver brazing.
4. An oxidizing flame is used to silver braze.
5. The flame should not be applied directly to the silver braze.
6. "Capillary Action" causes the silver solder to flow throughout the joint.
7. In a properly silver brazed joint, the metal will tear before the joint breaks.
8. If the temperature of the metal goes above 1300° F. the flux will "crawl" or leave bare areas.
9. It is not necessary to clean the surfaces before applying flux.
10. The joining of copper and brass is most commonly done by silver brazing.

DUTY

TASK

EN. Obj.

DEPT.

PROG.

1. F
2. T
3. F
4. F
5. T
6. T
7. T
8. T
9. F
10. T

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 1 OPERATING GAS WELDING EQUIPMENT

TASK: 0 5 Braze Ferrous and Nonferrous Metals

PURPOSE:

Brazing is a widely used process for many applications and particularly for cast iron. This learning guide will help you master the technique of brazing.

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY
TASK
PREREQ
DEPT.
PROG.
REVISED

DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: access to standard oxyacetylene welding and safety equipment, metal plates, pieces of cast iron, brazing rod, flux, and hand tools.

YOU WILL: braze ferrous and nonferrous metals.

HOW WELL: You must successfully complete the Knowledge Test. Your performance will be assessed by your instructor using the Performance Tests on pages 16, 20, 26, and 28.

ENABLING OBJECTIVES:

1. Define the terms used in this Learning Guide.
2. Obtain standard oxyacetylene safety and welding equipment, tools, and materials.
3. Prepare metal plates and deposit bronze weld beads.
4. Prepare metal plates and braze weld a butt joint.
5. Prepare metal plates and braze weld a tee joint.
6. Prepare cast iron and braze weld a vee butt joint.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1

number

PAGE 4 OF 28

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Define the terms used in this Learning Guide.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to define the welding terms used in this Learning Guide.	1. Instruction Sheet enclosed, Welding Terms
2. Evaluate your knowledge by completing the Self-Check.	2. Self-Check enclosed.
3. Go on to Enabling Objective No. 2.	

Welding Terms

1. Acetylene - a gas composed of two parts of carbon and two parts of hydrogen. When burned in an atmosphere of oxygen, it produces one of the highest flame temperatures obtainable.

2. Acetylene cylinder - a specially built container manufactured according to I.C.C. Standards. It is used to store and ship acetylene. Occasionally it will tank or bottle.

3. Acetylene regulator - an automatic valve used to reduce acetylene cylinder pressures to torch pressures and to keep the pressures constant.

4. Backfire - a short "pop" of the torch flame followed by extinguishing of the flame or continued burning of the gases.

5. Blowpipe - another term applied to the oxyacetylene torch.

6. Braze welding - making an adhesion groove, fillet, or plug connection with a brazing alloy.

7. Brazing - making an adhesion connection with a minumum of alloy which melts above 800° F. and which flows by capillary between close fitting parts.

8. Burned metal - a term applied to the metal which has been combined with oxygen to the point that some of the carbon has been changed into carbon dioxide and some of the iron into iron dioxide.

9. Burning - a violent combination of oxygen with any substance which produces heat. This word is sometimes used instead of flame cutting.

10. Cone - an inner visible flame shape of a neutral or near neutral flame.

11. Cutting flame - cutting by a rapid oxidation process at a high temperature produced by a gas flame accompanied by a jet action which blows the oxides away from the cut.

12. Cylinder - a contaniner used to hold gases.

13. Ferrous - iron bearing. It contains mostly iron.

14. Flux - a chemical used to promote fusion of metals during the welding process.

15. Hose - a flexible means used to carry gases from regulator to the torch. It is made of fabric and rubber.

16. Neutral flame - a flame which results from combustion of perfect proportions of oxygen and the welding gas.

17. Nonferrous - containing little or no iron.

18. Orifice - an opening through which gases flow. It is usually the final opening, or any opening controlled by a valve.

19. Oxidizing flame a flame which is produced by an excess of oxygen in the torch mixture, leaving some free oxygen which tends to burn the molten metal.

20. Oxygen - a gas formed of the element oxygen. When it very actively supports combustion it is called burning. When it slowly combines with a substance it is called oxidation.

21. Oxygen cylinder - a specially built container manufactured according to I.C.C. Standards and used to store and ship certain quantites of oxygen.

22. Puddle - a portion of a weld that is molten at the place the heat is supplied.

23. Tinning - a term applied to soldering where the metals to be soldered together are first given a coating of the soldering metal.

24. Tip - a part of the torch at the end where the gas burns, producing the high temperature flame.

25. Torch the mechanism which the operator holds during gas welding and cutting, at the end of which the gases are burned to perform the various gas welding and cutting operations.

SELF-CHECK FOR ENABLING OBJECTIVE 1

number

PAGE 7 OF 28

DUTY

TASK

EN OBJ

DEPT.

PROG.

DIRECTIONS:

Evaluate your knowledge by completing the items below. Use a separate sheet of paper.

1. A violent combination of oxygen with any substance which produces heat is called ________.
2. Soldering where the metals are first given a coating of the soldering metal is ________.
3. A container used to hold gases is called a ________.
4. ________ is another term applied to the oxyacetylene torch.
5. Cutting by a gas flame along with a jet action which blows oxides away from the cut is called ________.
6. ________ is gas formed of the element oxygen.
7. The mechanism which the operator holds during gas welding and cutting is a ________.
8. A flame which results from combustion of perfect proportions of oxygen and welding gas is a ___________.
9. ________ is a gas composed of 2 parts carbon and 2 parts hydrogen.
10. _______ is a portion of a weld that is molten at the place the heat is supplied.
11. A chemical used to promote fusion of metals during the welding process is ________.
12. An inner visible flame shape of a neutral flame is a ______.
13. _______ is the part of the torch at the end where the gas burns.
14. A container used for storing and shipping acetylene is called an ________.
15. A ________ is made of fabric and rubber and carries gases from the regulator to the torch.

16. ________ is making an adhesion connection with a minimum of alloy which melts above 800° F and which flows by capillary action between close fitting parts.

17. An _____ is an automatic valve used to reduce acetylene pressures to torch pressures and to keep the pressures constant.

18. Flame which is produced by an excess of oxygen in a torch mixture is an ________.

19. ________ is a short "pop" of the torch flame followed by extinguishing the flame.

20. Containing little or no iron is ______.

21. A container used for storing certain quantities of oxygen is called an _________.

22. The final opening through which gases flow is called an ________.

23. Containing mostly iron is __________.

24. Metal which has been combined with oxygen to the point that some of the carbon has been changed into carbon dioxide and some of the iron into iron oxide is ________.

Now check your answers with the Answer Key.

SELF-CHECK FOR ENABLING OBJECTIVE 1 number
ANSWER KEY

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

1. burning
2. tinning
3. cylinder
4. blowpipe
5. cutting flame
6. oxygen
7. torch
8. neutral flame
9. acetylene
10. puddle
11. flux
12. cone
13. tip
14. acetylene cylinder
15. hose
16. brazing
17. acetylene regulator
18. oxidizing flame
19. backfire
20. nonferrous
21. oxygen cylinder
22. orifice
23. ferrous
24. burned metal

All of your answers should agree with the answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

8

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE

2 number

PAGE 10 OF 28

DUTY

TASK

EN OBJ

DEPT

PROG

Enabling objective

Obtain standard oxyacetylene safety and welding equipment, tools, and materials.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify and locate safety and welding equipment, tools, and materials.	1. Instruction Sheet enclosed, Procedure for Selecting Equipment, Tools, and Materials
2. Assemble equipment, tools, and materials at your work station by following the procedure outlined in Resource No. 1	2. a. Safety and welding equipment. b. Tools c. Materials
3. Evaluate your work by completing the Self-Check.	3. Self-Check enclosed.
4. Go on to Enabling Objective No. 3.	

Procedure for Selecting Equipment, Tools, and Materials.

1. Obtain the following items:
   - a. Standard oxyacetylene safety and welding equipment
   - b. Safety glasses
   - c. Oxyacetylene goggles No. 5 shade lens
   - d. Gloves
   - e. Striker
   - f. Tongs
2. Obtain the following items from the tool crib:
   - a. W-17 welding head size No. 4
   - b. Disc grinder
   - c. Brazing flux
   - d. 3/32" x 36" bronze filler rod
3. Obtain the following items from the metal storage area:
   - a. 16 gauge x 2" x 8" metal plates
   - b. Cast iron pieces

SELF-CHECK FOR ENABLING OBJECTIVE 2 number PAGE 12 OF 28

DUTY

TASK

EN OBJ

DEPT.

PROG.

DIRECTIONS: Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

		YES	NO
1.	Were lens on the oxyacetylene goggles clean and free of smoke, weld splatter, etc.?....	____	____
2.	Were tongs or pliers used to handle hot metal after braze welding?......................	____	____
3.	Was grinding disc securely attached to the grinder?................................	____	____
4.	Was grinding disc free of broken or chipped edges?....................................	____	____
5.	Was correct size and type of filler rod used?	____	____

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

11

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 3 number

DUTY

TASK

EN OBJ

DEPT

PROG

Enabling objective

Prepare metal plates and deposit bronze weld beads.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the procedure for depositing a bead with a bronze filler rod and bronze weld.	1. a. PAT Workbook, Topic 25. b. Beseler Cue/See, Topic 25.
2. Practice depositing bronze weld beads by following the procedure outlined in Resource No. 2.	2. a. Metal plates b. Tools c. Brazing rod and flux
3. Evaluate your work by completing the Self-Check. Have your instructor check your work.	3. Self-Check enclosed
4. When you think you can perform this task, take the Performance Test.	4. Performance Test
5. Go on to Enabling Objective No. 4.	

DUTY

TASK

EN. OBJ

DEPT.

PROG.

DIRECTIONS:

Evaluate your knowledge by answering the items below on a separate sheet of paper.

1. Grinding to remove rust or mill scale is not necessary when braze welding.
2. Brazing flux acts as a cleaning agent.
3. A slightly carburizing flame is used when braze welding.
4. The bronze weld joint is as strong as a fusion welded joint.
5. The bronze filler rod adheres to the base metal by cohesion.
6. Bronze has a higher melting point than mild steel.
7. Braze welding should be done in a well ventilated area.

Now check your answers with the Answer Key.

SELF-CHECK FOR ENABLING OBJECTIVE 3 number
ANSWER KEY

PAGE 15 OF 2[illegible]

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

1. F
2. T
3. F
4. F
5. T
6. F
7. T

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 16 OF 28

DIRECTIONS: Given access to standard oxyacetylene welding and safety equipment, brazing rod, flux, and 16 gauge mild steel plate, you will prepare metal plates and deposit bronze weld beads. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Was metal cleaned before depositing the bronze weld?..		
2. Were weld beads uniform in width and 1/4" to 3/8" wide?..		
3. Were weld beads smooth with a uniform ripple?.............		
4. Was correct heat used coloring the base metal a dull red?..		
5. Was correct amount of flux used?.........................		
6. Were finished weld beads shiny in appearance?.............		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained
☐ Not attained

EVALUATOR

DEPT.

PROG.

BEST COPY AVAILABLE

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 4 number

PAGE 17 OF 28

DUTY
TASK
EN. OBJ
DEPT.
PROG.

Enabling objective

Prepare metal plates and braze weld a butt joint.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the procedure for preparing the metal and making a butt weld using a bronze filler rod.	1. a. PAT Workbook, Topic 26. b. Beseler Cue/See, Topic 26.
2. Practice making butt welds with a bronze filler rod by following the procedure outlined in Resource No. 1.	2. a. Bronze filler rod and flux b. Metal plates
3. Evaluate your knowledge by completing the Self-Check. Have your instructor check your work.	3. Self-Check enclosed.
4. When you think you can perform this task, take the Performance Test.	4. Performance Test
5. Go on to Enabling Objective No. 5.	

SELF-CHECK FOR ENABLING OBJECTIVE 4 number PAGE 18 OF 28

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your knowledge by answering the items below on a separate sheet of paper.

1. What type of flame is used in braze welding?
2. Why is it necessary to grind the edges and both sides of the metal near the edges when making a butt weld?
3. How can you tell when the metal plates are the proper temperature to add the bronze filler rod?
4. Why is braze welding faster than fusion welding?
5. Why is a braze joint not as strong as a fusion welded joint?

Now check your answers with the Answer Key.

SELF-CHECK FOR ENABLING OBJECTIVE 4 number
ANSWER KEY

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

1. A neutral flame is used in braze welding.

2. Grinding the edges and both sides of the metal near the edges removes all scale or oxides that could prevent the bronze from adhering to the metal.

3. The metal plates are at the right temperature when they reach a dull red color and the flux becomes fluid and looks wet.

4. Braze welding is faster than fusion welding because you do not melt the base metal. The bronze just adheres to the surface.

5. A braze joint is not as strong as a fusion welded joint because the base metal is not melted and the bronze is not fused with it.

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 20 OF 28

DIRECTIONS:

Given access to standard oxyacetylene safety and welding equipment, brazing rod, flux, and 16 gauge mild steel plate, you will prepare metal plates and braze weld a butt joint. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT

	YES	NO
1. Was metal cleaned before making the weld?		
2. Was correct heat used to make the weld causing the base metal to turn a dull red?		
3. Was there full penetration?		
4. Was the weld bead lightly convex with a smooth uniform ripple?		
5. Was the bend test performed?		
6. Was the weld bent at a 90° angle without breaking?		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 5 number PAGE 21 OF 28

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Prepare metal plates and braze weld a tee joint.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the procedure for preparing metal and braze welding a tee joint.	1. Instruction Sheet enclosed, Procedure for Preparing Metal and Braze Welding a Tee Joint
2. Practice depositing a tee weld with a bronze filler rod by following the procedure outlined in Resource No. 1.	2. a. Metal plates b. Bronze filler rod and c. Tools
3. Evaluate your knowledge by completing the Self-Check. Have your instructor check your work.	3. Self-Check enclosed.
4. When you think you can perform this task, take the Performance Test.	4. Performance Test
5. Go on Enabling Objective No. 6.	

Procedure for Preparing Metal Plates and Braze Welding

A Tee Joint

1. Grind one edge and both sides approximately 3/4" from the edge of 1 piece. See Figure 1 on the following page.

2. Grind an area approximately 3/4" wide through the center of a second piece. See Figure 2 on the following page.

3. Position and tackweld each end to form a "T". Ground surfaces must be together. See Figure 3 on the following page.

4. Position on fire brick and braze weld one side.

   a. Adjust for a slightly oxidizing flame.

   b. Starting at the right hand edge of the weld joint, heat the joint until both pieces are a dull red.

   NOTE: FLAME WILL NEED TO BE DIRECTED MORE AT THE BOTTOM PLATE TO HEAT BOTH PIECES UNIFORMLY.

   c. Flux the end of the welding rod and melt a small amount of bronze into the corner of the joint; manipulate the flame so that the bronze will flow evenly onto both pieces.

   d. Continue a weld across plates by alternately heating the base metal to a dull red just ahead of the puddle and then adding the filler rod.

   NOTE: ADD FLUX TO ROD AS NEEDED TO KEEP THE FILLER ROD FLOWING SMOOTHLY AND EVENLY.

   e. If the base metal gets too not, flash flame away for a few seconds and add more flux.

   f. Continue making these welds until the weld is evenly distributed on both pieces, has a smooth rippled appearance and is uniform in width along the entire length.

Figure 1

Grind one edge and both sides approximately 3/4" wide.

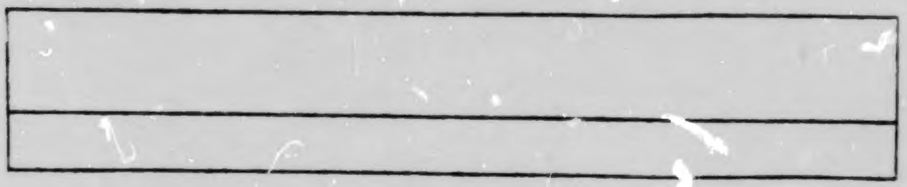


Figure 2

Grind approximately 3/4" wide on the center of one side.

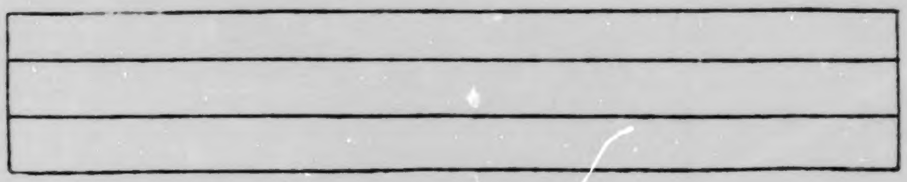
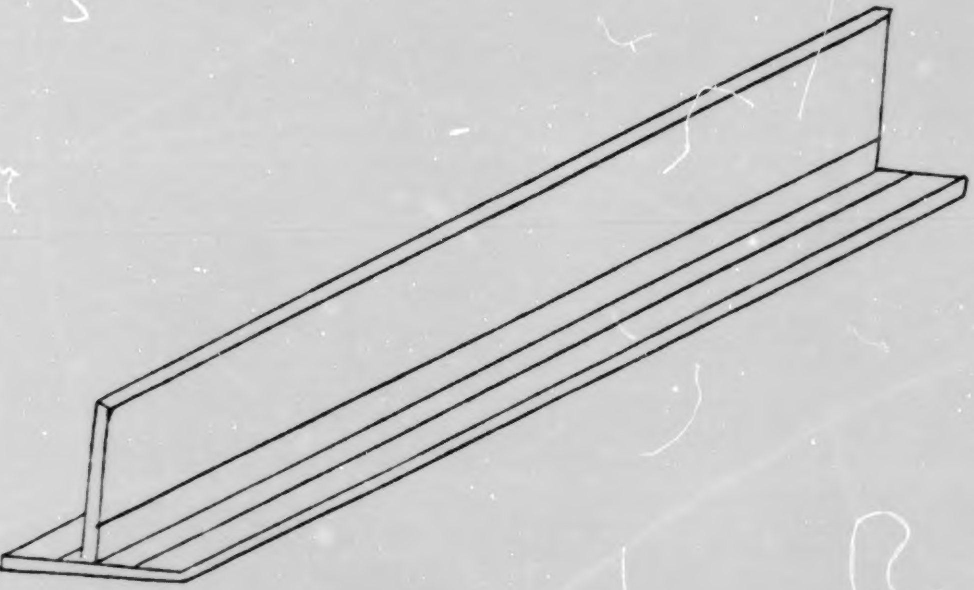


Figure 3

Position ground surfaces together. Tackweld each end.



DIRECTIONS:

Evaluate your knowledge by answering the items below on a separate sheet of paper.

1. When making a tee weld, why is it necessary to direct the flame more at the bottom plate?
2. If your base metal gets too hot, what are the two things you can do to cool it off?
3. How does the bronze react if the base metal is too hot?
4. How does the bronze react if the base metal is too cold?
5. Where must you add your filler rod to distribute the weld equally on both plates?

Now check your answers with the Answer Key.

SELF-CHECK FOR ENABLING OBJECTIVE 5 number
ANSWER KEY

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

1. It is necessary to direct the flame more at the bottom plate because you are not only heating the edge of the vertical piece but are heating the whole center of the bottom piece.

2. You can cool the base metal by turning the flame away from the metal or by adding flux to the metal.

3. When the base metal is too hot, the bronze will spark and smoke. You cannot control the puddle.

4. When the base metal is too cold, the bronze will "ball up" instead of flowing onto the base metal.

5. You must add your filler rod at the top front edge of the puddle to distribute the weld equally on both plates.

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 26 OF 28

DIRECTIONS:

Given access to standard oxyacetylene safety and welding equipment, brazing rod, flux, and a 16 gauge mild steel plate, you will prepare metal plates and braze weld a tee joint. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were plates ground according to the outlined procedure?..		
2. Were plates correctly positioned when tacking?...........		
3. Was the weld distributed evenly on both plates?...........		
4. Was the weld uniform in width and also the full length of the plate?..		
5. Was the weld smooth, shiny and possessed uniform ripples?..		
6. Was the bend test performed and passed?..................		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 6 number PAGE 27 OF 28

Enabling objective

Prepare cast iron and braze weld a vee butt joint.

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the procedure for preparing and braze welding cast iron.	1. a. PAT Workbook, Topic 27. b. Beseler Cue/See, Topic 27.
2. Practice braze welding cast iron by following the procedure outlined in Resource No. 1.	2. a. Cast iron b. Bronze filler rod and flux. c. Hand tools
3. When you think you can attain this task, take the Knowledge Test.	3. Knowledge Test
4. When you successfully complete the Knowledge Test, take the Performance Test.	4. Performance Test
5. Secure your work area.	

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 28 OF 28

DIRECTIONS:

Give access to standard oxyacetylene safety and welding equipment, brazing rod, flux, and pieces of cast iron, you will prepare cast iron and braze weld a vee butt joint. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were pieces ground to form a "V" of approximately 90°?		
2. Were surfaces ground back from the edges of the "V" so that the weld will be wider than the "V"?		
3. Was there 100% penetration?		
4. Was the weld slightly convex and wider than the "V"?		
5. Was the weld shiny and evenly rippled?		
6. Was the weld broken in the cast iron with some of the cast iron particles sticking to the bronze?		

DUTY
TASK
ATTEMPT
STUDENT
DATE
☐ Attained
☐ Not attained
EVALUATOR
DEPT.
PROG.

KNOWLEDGE TEST FOR ☐ ☐☐
duty task number

PAGE 1 OF 1

DUTY
TASK
DEPT.
PROG.

TASK: Braze Ferrous and Nonferrous Metals

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet, put T if the item is True and F if the item is False.

DO NOT MARK ON THIS TEST!

1. The correct size and type of filler rod must be used for braze welding.
2. The grinding disc must be free of broken or chipped edges.
3. Grinding to remove rust or mill scale is not necessary when braze welding.
4. Brazing flux acts as a cleaning agent.
5. The bronze weld joint is as strong as a fusion weld joint.
6. Bronze has a higher melting point than mild steel.
7. Braze welding is faster than fusion welding.
8. A carburizing flame is used to braze weld.
9. If the bronze wants to ball up and not flow, it indicates that base metal is too cold.
10. Applying a thin coating of bronze to the surfaces to be brazed is called thinning.
11. When brazing cast iron it is not necessary to preheat the entire casting.
12. The base metal is at the right temperature to add bronze when it turns a dull red and the flux becomes fluid.
13. If the base metal becomes too hot, the bronze will spark and smoke. The puddle will be difficult to control.
14. When brazing a tee joint, the flame should be directed more at the top or vertical member.
15. The included angle for a V-groove braze joint should be larger than the angle used for fusion welding process.

Braze Ferrous and Nonferrous Metals

Answer Key

True or False questions

1. T
2. T
3. F
4. T
5. F
6. F
7. T
8. F
9. T
10. T
11. F
12. T
13. T
14. F
15. T

BEST COPY AVAILABLE

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 1 OPERATING GAS WELDING EQUIPMENT

TASK: C 4 Gas Weld Cast Iron

PURPOSE:

Welding iron castings is sometimes necessary where the casting is subjected to high temperatures. The weld must have the same color and texture as the casting. After completion of this learning guide, you will be able to make a quality repair by welding a broken casting.

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY

TASK

PREREQ

DEPT.

PROG.

REVISED

DUTY | TASK | DEPT. | PROG.

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: access to standard oxy-acetylene safety and welding equipment, cast iron, tools, welding rod and flux.

YOU WILL: gas weld cast iron.

HOW WELL: You must succesfully complete the Knowledge Test. Your performance will be assessed by your instructor using the Performance Test.

ENABLING OBJECTIVES:

1. Identify terms and equipment used in gas welding cast iron.
2. Prepare to gas weld cast iron.
3. Practice gas welding cast iron.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1

number

PAGE 4 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Identify terms and equipment used in gas welding cast iron.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No.1 to identify welding terms used in gas welding cast iron.	1. Instruction Sheet enclosed, Welding Terms Used in Gas Welding Cast Iron
2. Read Resource No.2 to identify equipment, tools, and materials needed to gas weld cast iron.	2. Instruction Sheet enclosed Selection of Equipment, Tools, and Materials for Gas Welding Cast Iron
3. Evaluate your knowledge using the Self-Check.	3. Self-Check enclosed.
4. Go on to Enabling Objective No. 2.	

3

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 1 number PAGE 5 OF 12

DUTY | TASK | EN. OBJ. | DEPT. | PROG.

Welding Terms Used in Gas Welding Cast Iron

1. Ferrous - a metal that contains mostly iron.
2. Flux - a chemical used to promote fusion of metals during the welding process.
3. Neutral flame - a flame which results from combustion of perfect proportions of oxygen and welding gas.
4. Puddle - a portion of the weld tht is molten at the place where the heat is supplied.
5. Bevel - angling of the metal edge where welding is to take place.
6. Groove weld - a welding rod fused into a joint which has the base metal removed to form a V., U., or J at the edge of the metals to be joined.
7. Porosity - presence of gas pockets or voids in the metal.
8. Preheat - this will normalize the effects of expansion and contraction during the welding process.
9. Post heating - a means by which the cooling process can be prolonged.
10. Oxidizing flame - a flame which is produced by an excess of oxygen in the torch mixture.

Selection of Equipment, Tools, and Materials for Gas Welding Cast Iron

1. Obtain the following equipment:
   - a. standard oxy-acetylene safety and welding equipment
   - b. safety glasses
   - c. oxy-acetylene goggles
   - d. gloves
   - e. striker
2. Obtain the following tools and material from the tool crib:
   - a. two pieces of broken casting
   - b. can of welding flux
   - c. four 1/8" filler rods
   - d. ball peen hammer
   - e. insulating material
   - f. disk grinder

SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 7 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your knowledge by answering the items below on a separate sheet of paper.

1. A flame which is produced by an excess of oxygen in the torch mixture is called a/an __________ __________.

2. A means by which the cooling process can be prolonged is called ______ ______.

3. To normalize the effects of expansion and contraction when welding casting you should ________ ________ the casting.

4. The presence of gas pockets or voids in the metal is called ________.

5. A joint with the base metal removed to form a V is called a _________ weld.

6. Angling of the metal edge where welding is to take place is called _______.

7. A _______ is the portion of a weld that is molten where the heat is supplied.

8. A flame which results from combustion of perfect proportions of oxygen and the welding gas is a ________ _______.

9. A chemical used to promote fusion of metals during the welding is called _________.

10. A metal that contains mostly iron is a ________ metal.

Now check your answers with the Answer Key.

SELF-CHECK FOR ENABLING OBJECTIVE 1 number

ANSWER KEY PAGE 8 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

1. oxidizing flame
2. post heating
3. preheat
4. porosity
5. groove
6. beveling
7. puddle
8. neutral flame
9. flux
10. ferrous

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 9 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Prepare to gas weld cast iron.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Have instructor give a demonstration on gas welding cast iron.	1. Instructor
2. When you think you can attain this task, take the Knowledge Test.	2. Knowledge Test.
	8

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 3

number

PAGE 10 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Practice gas welding cast iron.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. See instructor for your job of gas welding cast iron.	1. Instructor
2. Practice gas welding cast iron.	2. a. Work station b. Cast iron pieces c. Tools d. Welding rod and flux.
3. Have instructor check your work.	3. Instructor
4. When completed, secure your area.	4. Cleaning equipment
5. When you think you can perform this task, take the Performance Test.	5. Performance Test.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 11 OF 12

DIRECTIONS:

Given access to standard oxy-acetylene safety and welding equipment, cast iron, tools, welding rod and flux, you will prepare cast iron and make a vee-butt weld. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were the pieces ground to form a "V" of approximately 90°?..		
2. Were the surfaces ground back from the edges of the "V" so that the weld would be wider than the "V"?..................		
3. Was there 100% penetration on the weld?........................		
4. Was the weld slightly convex and wider than the "V"?...........		
5. Was the correct procedure used to cool the welded casting?...		
6. Was the dye penetration test passed by the casting?..........		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

DUTY

TASK

DEPT.

PROG.

Instructional Resources

Materials

Cast iron and flux.

KNOWLEDGE TEST FOR ☐ duty ☐☐ task number

PAGE 1 OF 1

DUTY

TASK

DEPT.

PROG.

TASK: Gas Weld Cast Iron.

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet. Put T if the item is True and F if the item is False.

DO NOT MARK ON THIS TEST!

1. If a casting is cooled rapidly, the weld area may become brittle.
2. The correct type and size of filler rod must be used to gas weld cast iron.
3. When welding cast iron, the weld puddle must be stirred to make the weld metal flow to the sides.
4. The grinding disk must be free of broken or chipped edges.
5. The shape of a finished weld should be slightly concave.
6. A carburizing flame is used to weld cast iron.
7. A freshly welded casting is covered with an insulating material to contain the heat as long as possible.
8. Gas welding cast iron is a fusion welding process.
9. Grinding to remove rust or mill scale is not necessary when welding cast iron.
10. When tapping a casting lightly with a hammer, you know the casting is sound if you hear a dull thud.

1. T
2. T
3. F
4. T
5. F
6. F
7. T
8. T
9. F
10. F

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 4 FABRICATING PIPE JOINTS

TASK: 0 1 Prepare Pipe Joints for Welding

PURPOSE:

Welders are sometimes required to cut, bevel, and fit pipe in various shapes and sizes. This learning guide will help you develop the skills needed to become competent in fabricating pipe joints.

DUTY

TASK

PREREQ.

DEPT.

PROG.

REVISED

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:
(include condition, performance, and standard)

GIVEN: access to equipment, metal, electrodes, and work station,

YOU WILL: prepare pipe joints for welding.

HOW WELL: You must successfully complete the Knowledge Test. Your performance will be assessed by your instructor using the Performance Test on page 21.

ENABLING OBJECTIVES:

1. Identify pipe sizes.
2. Cut pipe to form a 90° elbow.
3. Cut pipe to form a tee joint.
4. Cut pipe to form a 90° Y joint.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number

PAGE 4 OF 21

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Identify pipe sizes.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to determine the steps in identifying pipe sizes.	1. Text: Pipe Welding Techniques, Unit 11, Figure 11-5, page 61.
2. Evaluate your work by completing the Self-Check.	2. Self-Check enclosed.
3. Go on to Enabling Objective No. 2.	

SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 5 OF 21

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

		YES	NO
1.	Was there a difference between standard and schedule 40 pipe?..........................	____	____
2.	Were dimensions given in inches?...........	____	____
3.	Were decimal thicknesses listed for respective pipe sizes representing their nominal or average wall dimensions?........	____	____
4.	Was the actual thickness as much as 12.5% or under the nominal thickness because of mill tolerance?................................	____	____

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number PAGE 6 OF 21

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Enabling objective:

Cut pipe to form a 90° elbow.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the steps in cutting pipe to form a 90° elbow.	1. Instruction Sheet enclosed, Layout and Cut Pipe for a 90° Elbow.
2. Practice laying out and cutting pipe by following the procedure outlined in Resource No. 1.	2. a. Equipment b. Tools c. Materials - pipe 3" or more in diameter x 12" long
3. Evaluate your work by completing the Self-Check.	3. Self-Check enclosed.

Layout and CutPipe for a 90° Elbow

1. Standard Oxyacetylene cutting outfit and protective equipment.
2. Center finder
3. Square
4. Level
5. Wrap-around
6. Center punch and ball peen hammer
7. Soap stone
8. Measuring tape

Layout and Mark:

1. Use center finder, square, and level to layout and mark your center lines on pipe. Refer to Figure 1 below.
2. Use wrap-around to layout and mark a circumferential line at center of pipe. Refer to Figure 2 below.

Figure 1

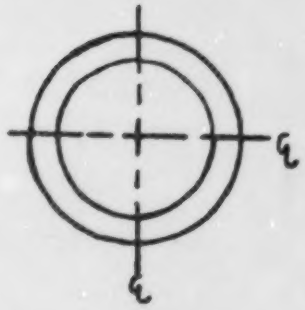
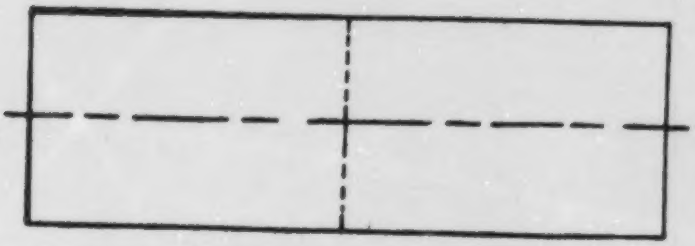


Figure 2

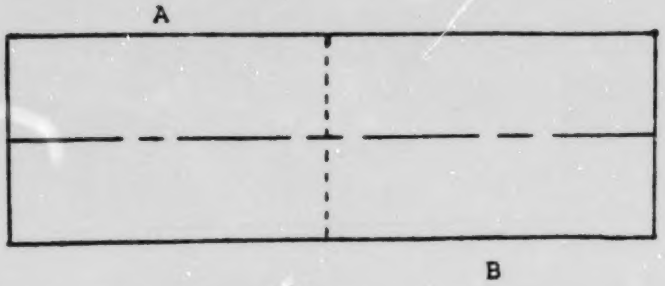


3. Use measuring tape to mark cutback points A and B on center lines of pipe. Refer to Figure 3 on the following page. Measuring from circumferential line. The formula for finding cut back dimension is: outside diameter divided by 2

$\frac{\text{OD.}}{2}$

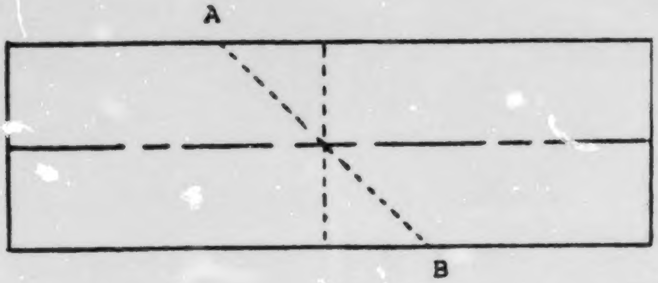
6

Figure 3



4. Use wrap-around to mark cutting line from points A and B all around pipe. Refer to Figure 4 below.

Figure 4



5. Center punch cutting line at 1/2" intervals.

Cutting the Pipe:

1. Cut pipe as marked. Keep torch angle aligned with angle of mark and pointed towards center of pipe. Refer to Figures 5 and 6 below.

Figure 5

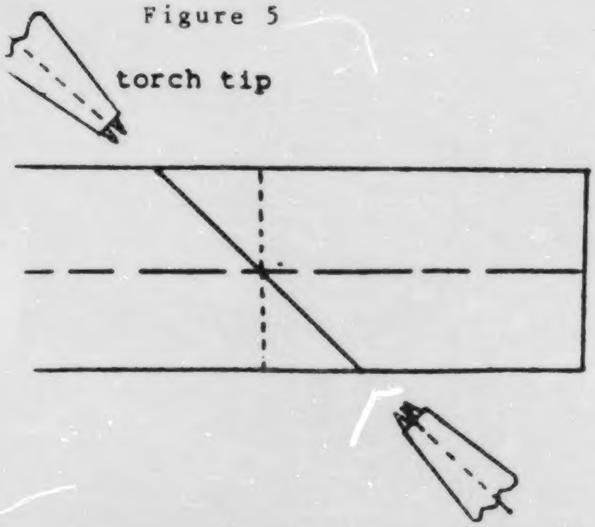
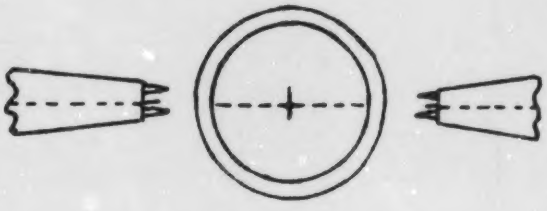


Figure 6



2. Bevel both pieces of pipe for 30° to 45° angle from face of pipe. Leave 1/16" to 1/8" at root face. Refer to Figure 7 and 8 below.

Figure 7

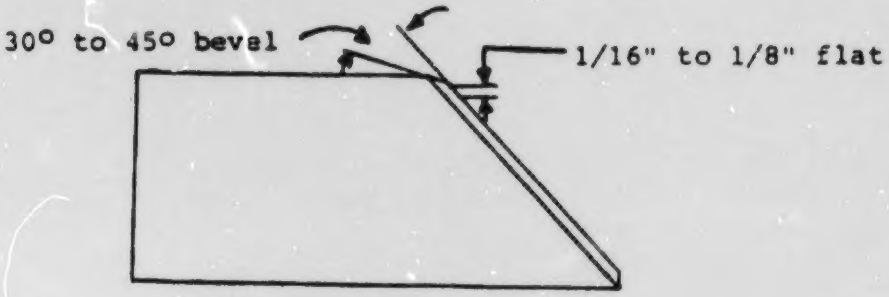
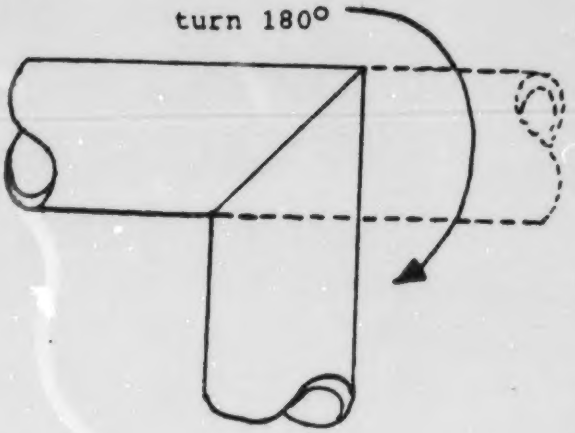

30° to 45° bevel
1/16" to 1/8" flat

Figure 8



3. Hold prepared pipes for task I-2.

SELF-CHECK FOR ENABLING OBJECTIVE 2 number PAGE 10 OF 21

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Were cut lines center punched at 1/2" intervals?..............................	____	____
2. Was the formula $\frac{OD}{2}$ used to find cutback points A and B?..........................	____	____
3. Was torch tip aligned with the cut line and pointed at the center of the pipe when cutting?.................................	____	____
4. Were both pieces of pipe 30° to 45° beveled leaving a 1/16" to 1/8" flat at root face?...................................	____	____

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 3 number PAGE 11 OF 21

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Cut pipe to form a tee joint.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify the steps in cutting pipe to form a tee joint.	1. Instruction Sheet enclosed, Layout and Cut Pipe for a Tee Joint.
2. Practice laying out and cutting pipe by following the procedure outlined in Resource No. 1. Have your instructor check your work.	2. a. Equipment b. Tools c. Materials - pipe 3" or more in diameter x 12" long
3. Evaluate your work by completing the Self-Check.	3. Self-Check enclosed.
4. Go on to Enabling Objective No. 4.	

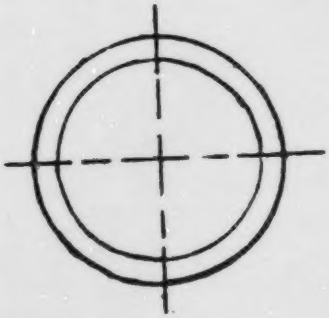
Layout and Cut Pipe for a Tee Joint

Tools and Equipment needed:

1. Standard oxyacetylene cutting outfit and protective equipment
2. Center finder
3. Square
4. Level
5. Wrap-around
6. Center punch and ball peen hammer
7. Soap stone
8. Measuring tape

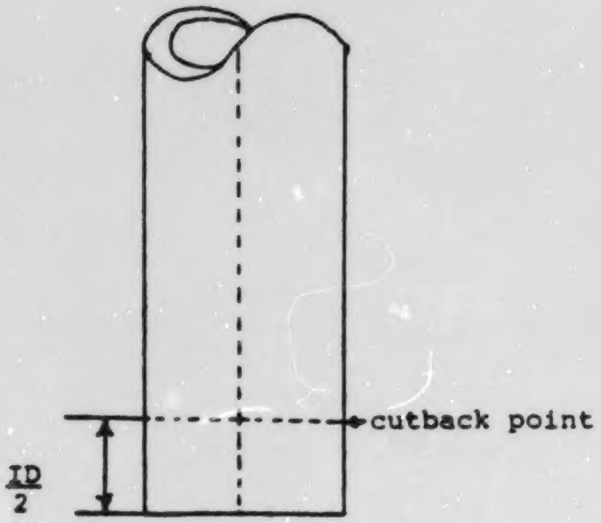
Layout, Mark, and Cut:

1. Use measuring tape and wrap-around to layout and mark a circumferential line at center of pipe. Center punch at 1/2" intervals.
2. Cut pipe at circumferential line. Keep torch tip perpendicular to line, pointed at center of pipe.
3. Use center finder, square, and level to layout and mark four center lines on both pieces of pipe. Refer to Figure 1 below.



4. Measure from end of one pipe along one center line and mark cutback point. Measure and mark the opposite center line in same manner. The amount of cutback is equal to 1/2 the inside diameter of the pipe ($\frac{ID}{2}$). Refer to Figure 2 on the following page. This piece is called the branch.

Figure 2



5. Mark from these two points to remaining center lines at end of pipe. Center punch at 1/2" intervals. Refer to Figure 3 below. Cut at marks and round off corners. Refer to Figure 4 below.

Figure 3

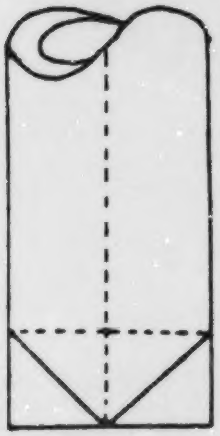
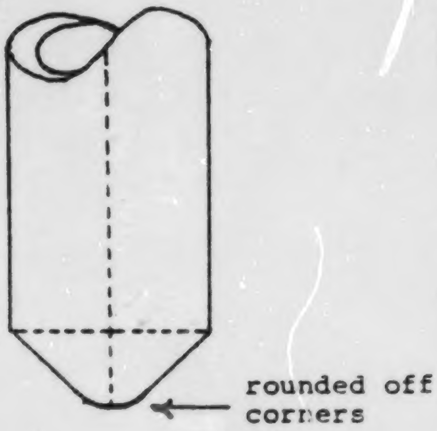


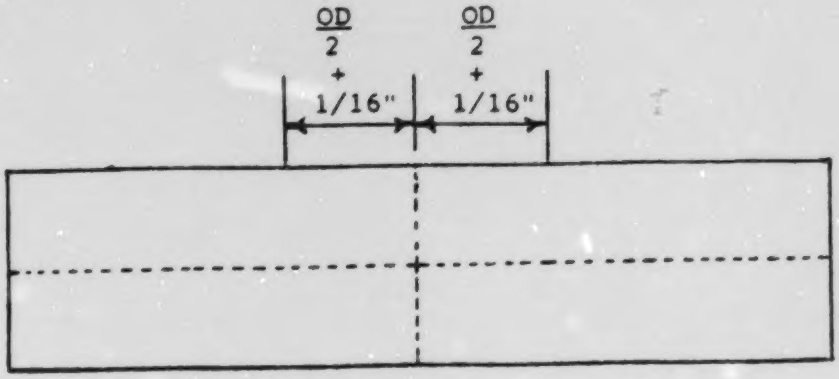
Figure 4



6. Use wrap-around to mark a circumferential line at center of remaining piece of pipe. Center punch at 1/2" intervals. This piece is called the header.

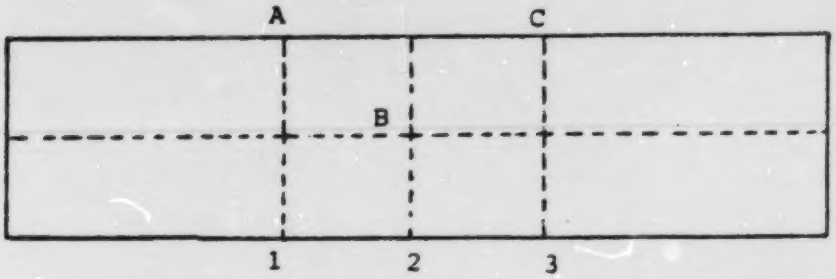
7. Along one center line, measure back from circumferential line 1/2 outside diameter of pipe plus 1/16" ($\frac{OD}{2}$ + 1/16") and mark. Mark opposite side of circumferential line in the same manner. Refer to Figure 5 on the following page.

Figure 5



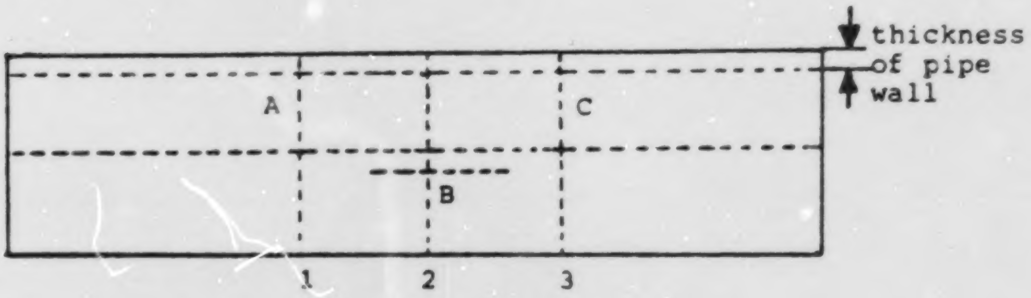
8. Use wrap-around and mark lines 1 and 3 around pipe at marks established in Step No. 7. Refer to Figure 6 below.

Figure 6



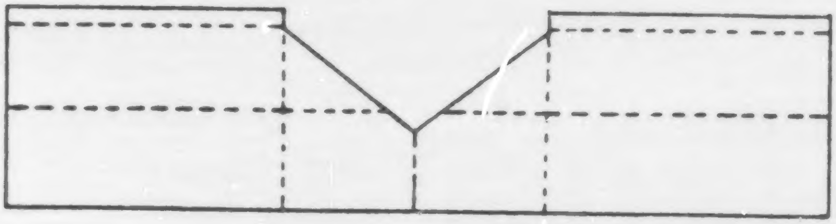
9. Drop points A, B, and C down equal to thickness of pipe wall. Mark from A to B and B to C on both sides of pipe. Center punch marks at 1/2" intervals. Refer to Figure 7 below.

Figure 7



10. Cut at marks. Refer to Figure 8 on the following page. Keep torch tip perpendicular to surface and pointed at center of pipe. Bevel hole in pipe 45° all the way around leaving 1/16" to 1/8" root face.

Figure 8



11. Hold prepared pipes for task I-02.

SELF-CHECK FOR ENABLING OBJECTIVE 3 number

PAGE 16 OF 21

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS: Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a YES response.

	YES	NO
1. Were four center lines laid out and marked on each piece of pipe...........................	____	____
2. Was formula $\frac{ID}{2}$ used to mark the cutback points on one end of the pipe?...............	____	____
3. Were corners rounded off after cutting the pipe?......................................	____	____
4. Was formula $\frac{OD}{2}$ + 1/16" used to mark the cutback points for the hole in the other piece of pipe?.............................	____	____
5. Were points A, B, and C dropped a distance equal to the thickness of the pipe wall before marking the cutting lines?....................	____	____
6. Was hole beveled in the pipe 30° to 45° leaving a 1/16" to 1/8" root face?............	____	____

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 4

number

PAGE 17 OF 21

DUTY	TASK	EN. OBJ.	DEPT.	PROG.

Enabling objective

Cut pipe to form a 90° Y joint.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the steps in cutting pipe to form a 90° Y joint.	1. Instruction Sheet enclosed, Layout and Cut Pipe to Form a 90° Y Joint
2. Practice laying out and cutting pipe by following the procedure outlined in Resource No. 2.	2. a. Equipment b. Tools c. Materials - pipe 3" or more in diameter x 18" long d. Work station
3. Evaluate your work by completing the Self-Check.	3. Self-Check enclosed.
4. When you think you can attain this task, take the Knowledge Test.	4. Knowledge Test.
5. When you successfully complete the Knowledge Test, take the Performance Test.	

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Layout and Cut Pipe to Form a 90° Y Joint

Tools and Equipment Needed:

1. Standard oxyacaetylene cutting outfit and protective equipment.
2. Center finder
3. Square
4. Level
5. Wrap-around
6. Center punch and ball peen hammer
7. Soap stone
8. Measuring tape

Layout, Mark, and Cut:

1. Layout and mark four center lines on pipe. Refer to Figure 1 below.
2. Layout and mark two circumferential lines at 6" intervals. Center punch at 1/2" intervals. Refer to Figure 2 below.

Figure 1

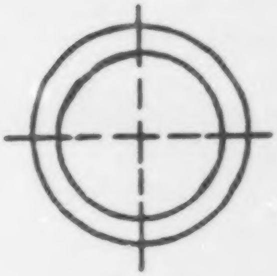
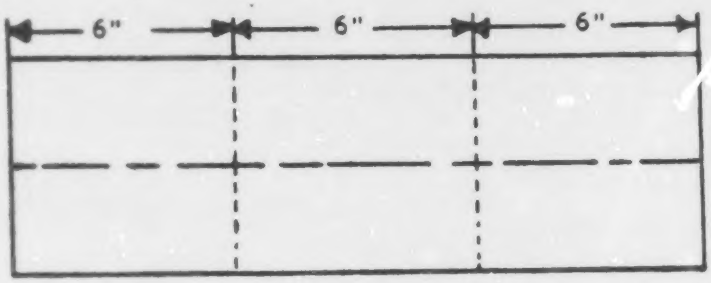


Figure 2



3. Cut pipe into 3 pieces.
4. Layout and mark cut back for each piece of pipe. Use formula $\frac{OD}{2}$ x constant. Center punch at 1/2" intervals. Refer to Figures 3, 4, and 5, on the following page.

Figure 3
header

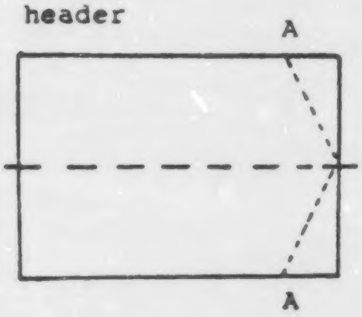


Figure 4
leg

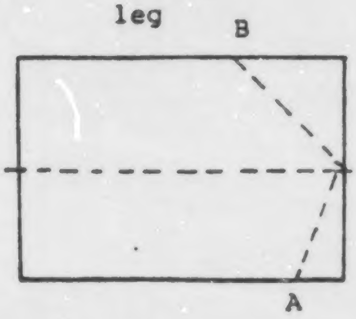
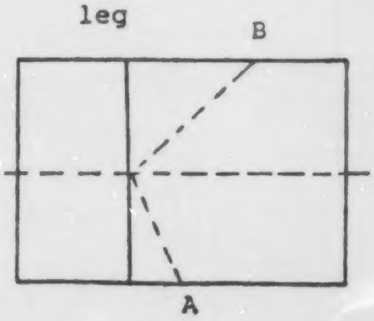
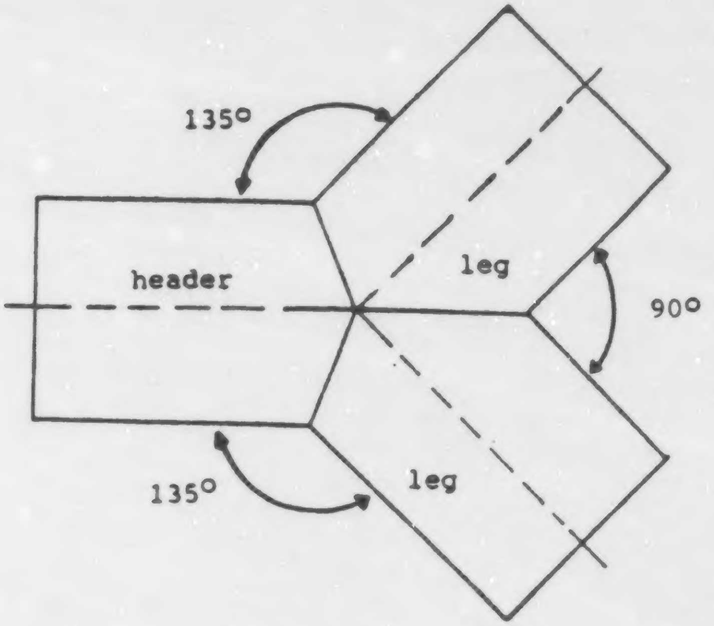


Figure 5
leg



5. Cut pipe as marked.

6. Fit pieces together and inspect for proper fit. Refer to Figure 6 below.



7. Bevel all edges 30° to 45° leaving 1/16" to 1/8" flat root face.

8. Hold all pieces for task I-02.

SELF-CHECK FOR ENABLING OBJECTIVE ☐ number PAGE 1 OF 1

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Were four center lines marked on pipe before cutting it into three pieces?.........	____	____
2. Were correct formulas used when marking the cutback points on the three pieces of pipe?..	____	____
3. Were the pieces fitted together to form a Y joint without excess gap (space) along weld joints?......................................	____	____
4. Was a 90° angle and two 135° angles formed when the pieces were joined?.................	____	____
5. Were all pieces beveled 30° to 45° leaving a 1/16" to 1/8" root face?...................	____	____

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR I 0 1

duty task number

PAGE 20 OF 21

DIRECTIONS:

Given access to equipment, metal, electrodes, and work station, you will prepare pipe joints for welding. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were both pieces of pipe beveled 30° to 45° on the 90° elbow?....................................		
2. Were pipe pieces fitted together without excess space at any point?..		
3. Were the corners rounded off on the branch pipe for the tee joint?...		
4. Were points A, B, and C dropped one wall thickness when marking the cut lines in the header of the tee joint?..		
5. Was the hole in the header pipe beveled 30° to 45°?...		
6. Was the angle formed by the legs of the Y joint 90°?...		
7. Was the angle formed by the header and legs 135°?........		
8. Were all pieces beveled 30° to 45° leaving 1/16" to 1/8" root face?..		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

Instructional Resources

Texts

Griffin, Roden, and Briggs, Pipe Welding Techniques, Delmar Publishers, Albany, New York, 1975.

Materials

Schedule 40 or 80 steel pipe, 2" or 4" diameter steel pipe

KNOWLEDGE TEST FOR ☐ ☐☐
duty task number

PAGE 2 OF 2

DUTY | TASK | DEPT. | PROG.

TASK: Prepare Pipe Joints for Welding

DIRECTIONS:
The items below are True-False. On the separate Answer Sheet, circle T if the item is True and F if the item is False.

DO NOT MARK ON THIS TEST!

1. You have to turn one piece of pipe 90° from original position to form a 90° elbow.
2. It is not necessary to mark four center lines when laying out a 90° elbow.
3. When laying out the branch pipe for the tee joint, the cutback formula is $\frac{ID}{2}$.
4. The formula for finding the cutback points on the header is $\frac{OD}{2}$ + 1/16".
5. Both the branch pipe and header pipe should be beveled.
6. The constants for finding the cutback points on all three pieces of pipe for a Y joint are the same.
7. The angle formed by the legs of a Y joint is 90°.
8. All edges should be beveled on the three pieces for a Y joint.
9. Extreme care must be taken to point the torch tip toward the center of the pipe when cutting any member of a pipe joint.
10. It is not necessary to center punch the cutting lines.

. . . .

Multiple Choice questions

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.___3.
.___4.
.___5.
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____19.
____20.
____21.
____22.
____23.
____24.
____25.

True-False questions

T [✓ F] 1.
T [✓ F] 2.
[✓ T] F 3.
[✓ T] F 4.
T [✓ F] 5.
T [✓ F] 6.
[✓ T] F 7.
[✓ T] F 8.
[✓ T] F 9.
T [✓ F] 10.
T F 11.
T F 12.
T F 13.
T F 14.
T F 15.
T F 16.
T F 17.
T F 18.
T F 19.
T F 20.
T F 21.
T F 22.
T F 23.
T F 24.
T F 25.

Matching questions

.____1.
.____2.
.____3.
.____4.
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____6.
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STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: C Completing Core Curriculum

TASK: 0 1 Identify Metals by Appearance and Weight

PURPOSE:

Your first step in preparing for welding and cutting operations is to identify the type or kind of metal you will be welding or cutting. Welding methods vary depending on the type of material used. You must be able to recognize different metals and alloys. This Learning Guide will enable you to identify metals by appearance and weight.

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY
TASK
PREREQ.
DEPT.
PROG.
REVISED

2

THE SCHOOL BOARD OF PALM BEACH COUNTY

DEPARTMENT OF VOCATIONAL-TECHNICAL EDUCATION

North Technical Education Center
7071 Garden Road
Riviera Beach, Florida 33404

South Technical Education Center
1300 S. W. 30th Avenue
Boynton Beach, Florida 33435

West Technical Education Center
2625 State Road 715
Belle Glade, Florida 33430

E. Miles Bacon, Director of Vocational-Technical Education

Wilma McCarty, Curriculum and Staff Development Specialist

THIS STUDENT LEARNING GUIDE WAS DEVELOPED BY:

Vince Repper, Welding Instructor
North Technical Education Center

Jim Schmidt, Welding Instructor
South Technical Education Center

Joe Smith, Welding Instructor
West Technical Education Center

This student learning guide was adapted from the VIMAS Decentralized Welding Project funded through the Florida Department of Education.

The format used in this student learning guide is one of the products developed through a grant from the Division of Vocational Education, Florida Department of Education which designated Ridge Vocational-Technical Center as a state demonstration site for competency-based vocational education.

DUTY	TASK	DEPT.	PROG.

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: access to various metal samples and record sheets,

YOU WILL: identify metals by appearance and weight.

HOW WELL: You must successfully complete the Knowledge Test. Your performance will be assessed by your instructor using the Performance Test.

ENABLING OBJECTIVES:

1. Recognize fundamental procedures in metal identification by appearance and weight.
2. Practice identifying various samples of metal by appearance and weight.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number

PAGE 4 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Recognize fundamental procedures in metal identification by appearances and weight.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to recognize fundamental procedures of metal identification by appearance and weight.	1. Text: Welding Encyclopedia, "Metal Identification", pages M-16 to M-18.
2. Complete the Self-Check.	2. Self-Check enclosed.
3. When you think you can attain this task, take the Knowledge Test.	3. Knowledge Test.
4. Go on to Enabling Objective No. 2.	

3

SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 5 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your knowledge by answering True or False to the items below on a separate sheet of paper.

1. The ability to detect differences in metals is the basis of metal identification.
2. A visual test of metals is different from metal identification by appearance.
3. The form, weight, shape, and color are the most important features to consider in metal identification by the welder.
4. Identification of metals by the welder is basically a process of elimination.
5. Mold parting lines and surface appearance is a positive identification of cast material.
6. Reinforcing rods cannot be identified by surface appearance.
7. Although similar in appearance, aluminum and pot metal can easily be distinguished by weight.
8. The fracture test is not a part of metal identification by appearance.
9. The surface appearance of steel plate and shapes can indicate hot rolling or cold rolling in the manufacturing process.
10. All metals have a silvery color.
11. Deoxidized copper has the same color appearance as copper penny.
12. Copper-nickel is the metal of which nickels (5c) are made.

1. T
2. F
3. T
4. T
5. T
6. F
7. T
8. F
9. T
10. F
11. T
12. T

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objectives.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 7 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Practice fundamental procedures in metal identification by appearance and weight.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to detect the differences in pre-identified samples of metals.	1. Kit No. 1: "Samples of Metals".
2. Practice identifying various samples of metals.	2. Kit No. 2: Unlabeled code samples of metals.
3. Complete the Self-Check. Have your instructor check your work.	3. Instructor
4. When you think you can attain this task, take the Performance Test.	4. Performance Test.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 8 OF 12

DIRECTIONS:

Given access to metal samples, you will identify metals by appearance and weight. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were weight differences of samples used to establish identification?..........		
2. Was surface texture considered as a mean of identification?..........		
3. Was color of unoxidized metal used as a clue to identification?..........		
4. Was fracture appearance used as a method of identification?..........		
5. Were surface oxides used as a method of identification?..........		
6. Was the manufactured (processed) shape considered in identification?..........		
7. Were all samples identified and recorded?..........		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

Instructional Resources

Texts

Cary, Howard B., Modern Welding Technology, Prentice-Hall, New Jersey, 1979.

Jefferson, Ted B., The Welding Encyclopedia, Monticello Books, Morton Grove, Illinois, 1968.

KNOWLEDGE TEST FOR ☐ ☐☐

duty task number

PAGE 10 OF 12

DUTY | TASK | DEPT. | PROG.

TASK: Identify Metals by Appearance and Weight

DIRECTIONS:

Evaluate your knowledge by answering the items below on a separate sheet of paper.

The items below are multiple Choice. On the separate Answer Sheet, put the letter of the correct answer on the blank to the left of the question.

1. Aluminum and its alloy have a color appearance of:
   a. dark grey.
   b. bluish white.
   c. light grey.
   d. yellow.

2. A cast iron product can be identified by visual inspection of:
   a. surface appearance.
   b. mold parting lines.
   c. shape.
   d. all of the above.

3. A reddish yellow color usually indicates that the metal is:
   a. zinc.
   b. copper-nickel.
   c. nickel-copper.
   d. bronze.

4. Magnesium, when compared to aluminum for identification purposes is:
   a. lighter than aluminum.
   b. heavier than aluminum.
   c. equal to aluminum.
   d. none of the above.

The items below are True-False. On the separate Answer Sheet, circle T if the item is True and F if the item is False.

1. On identifying metals by color the oxidation must never be scraped off.

2. Evidence of sand molds can be used to identify cast materials.

3. The biggest difference between gold and polished brass in rapid identification is the weight.

4. Magnesium can be easily mistaken for aluminum.

5. It is difficult to distinguish differences between low carbon and high carbon steels.

KNOWLEDGE TEST ANSWER KEY

DUTY D
TASK 01
DEPT. IN
PROG. 9943

Multiple Choice questions

b 1.
d 2.
d 3.
a 4.
___5.
___6.
___7.
___8.
___9.
___10.
___11.
___12.
___13.
___14.
___15.
___16.
___17.
___18.
___19.
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___23.
___24.
___25.

True-False questions

T [✓ F] 1.
[✓ T] F 2.
[✓ T] F 3.
[✓ T] F 4.
[✓ T] F 5.
T F 6.
T F 7.
T F 8.
T F 9.
T F 10.
T F 11.
T F 12.
T F 13.
T F 14.
T F 15.
T F 16.
T F 17.
T F 18.
T F 19.
T F 20.
T F 21.
T F 22.
T F 23.
T F 24.
T F 25.

Matching questions

___1.
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STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

DUTY
TASK
PREREQ.
DEPT.
PROG.
REVISED

PROGRAM: WELDING

DUTY: 1 OPERATING GAS WELDING EQUIPMENT

TASK: 0 1 Set-up Portable Oxy-fuel Equipment

PURPOSE:

Proper handling of welding equipment is essential to safety, obtaining good welds, and a reasonable amount of service from the equipment. Because of high pressures in the oxygen cylinder and the ease of combustion of acetylene it is necessary to be careful when handling cylinders. The procedures and safety measures that apply to portable equipment also apply to stationery equipment.

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OBJECTIVES PAGE 3 OF 14

DUTY	
TASK	
DEPT.	
PROG.	

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: access to equipment, metal, electrodes, and a work station,

YOU WILL: set-up portable oxy-fuel equipment.

HOW WELL: You must successfully complete the Knowledge Test. Your performance will be assessed by your instructor using the Performance Test on page 13.

ENABLING OBJECTIVES:

1. Identify oxy-fuel welding terms and safety practices.
2. Select protective equipment, tools, and welding equipment.
3. Set-up portable oxycetylene welding station.
4. Light a torch, adjust for the proper flame and secure the equipment.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number

PAGE 4 OF 14

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Identify oxy-fuel welding terms and safety practices.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No.1 to identify welding terms and safety practices in setting up portable oxy-fuel equipment.	1. a. PAT Workbook, Topics 1 and 2, pages 1-5. b. Beseler Cue/See, Topics 1 and 2.
2. Evaluate your knowledge by completing the Self-Check.	2. Self-Check enclosed.
3. Go on to Enabling Objective No. 2.	3

SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 5 OF 14

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your knowledge by answering the items below on a separate sheet of paper.

Evaluate your knowledge by matching the items below on a separate sheet of paper.

1. The noise associated with a momentary recession of the flame into the welding or cutting tip.
2. Used to ignite an oxy-fuel torch.
3. A tool used to open and close an acetylene cylinder.
4. A device for controlling the delivery of gas at some substantially constant pressure.
5. A fuel gas flame in which the portion used is neither oxidizing nor reducing.

a. striker

b. regulator

c. welding tip

d. torch

e. backfire

f. tee wrench

g. neutral flame

Evaluate your knowledge by answering True or False to the items below on a separate sheet of paper.

1. Oil can not be used on hose and regulator fittings because it collects dirt.
2. You should never strike an arc on oxycetylene cylinders.
3. The purpose of a protector cap on cylinders is to keep out dust.
4. It is impossible to install an acetylene regulator on an oxygen cylinder because they are a different size.
5. The proper method for checking leaks is with soap and water.

Now check your answers wivth the Answer Key.

SELF-CHECK FOR ENABLING OBJECTIVE 1 number
ANSWER KEY

PAGE 6 OF 14

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

1. e
2. a
3. f
4. b
5. g

1. F
2. T
3. F
4. F
5. T

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

5

EARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 7 OF 14

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

abling objective

Select protective equipment, tools, and welding equipment.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify and locate welding equipment and tools.	1. Instruction Sheet enclosed Selecting Weldinig Equipment and Tools
2. Assemble tools and equipment at your work station.	2. a. Equipment b. Tools c. Work station
3. Evaluate your work by completing the Self-Check.	3. Self-Check enclosed
4. Go on to Enabling Objective No. 3.	

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Selecting Welding Equipment and Tools

Follow the steps listed below in order.

1. Personal protective equipment
   a. oxyacetylene goggles
   b. gloves
   c. striker
2. Obtain the following items:
   a. oxygen regulator
   b. acetylene regulator
   c. 12 1/2 oxyacetylene twin hose
   d. welding torch
   e. welding tip size No.2
   f. 12" adjustable wrench
   g. oxyacetylene cart
   h. tee wrench
3. Go to the oxygen and acetylene storage area and obtain one oxygen and one acetylene cylinder and securely fasten them to the cart.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 3

number

PAGE 9 OF 14

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

Enabling objective

Set-up portable oxyacetylene welding station.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the steps in setting up a portable oxyacetylene welding station.	1. a. PAT Workbook, Topic 3, pages 13-16. b. Beseler Cue/See, Topic 3.
2. Set-up a portable oxyacetylene welding station.	2. Equipment
3. Complete the Self-Check.	3. Self-Check enclosed
4. When you think you can attain this task, take the Knowledge Test.	

SELF-CHECK FOR ENABLING OBJECTIVE 3 number PAGE 10 OF 14

DUTY

TASK

EN. OBJ

DEPT.

PROG.

DIRECTIONS: Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

		YES	NO
1.	Was protective equipment worn or used?		
	a. oxyacetylene goggles?...............		
	b. gloves?...........................		
	c. striker?............................		
2.	Were the oxygen and acetylene regulators obtained?..............................		
3.	Was twin hose in safe and usable condition?		
4.	Was torch in working condition?		
5.	Was No. 2 size tip used?................		
6.	Were cylinders secured to the cart?.......		

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 4

number

PAGE 11 OF 14

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Light a torch, adjust for the proper flame and secure the equipment.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Review Resource No. 1 to identify the steps in lighting and adjusting a torch.	1. a. PAT Workbook, Topic 3, pages 13-16. b. Beseler Cue/See, Topic 3.
2. Set-up a portable oxyacetylene welding station with the instructor present.	2. a. Equipment b. Tools c. Instructor
3. Light the torch, adjust for a proper flame and secure equipment with the instructor present.	3. a. Equipment b. Tools c. Instructor
4. When you think you can perform this task, take the Performance Test.	4. Performance Test

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SELF-CHECK FOR ENABLING OBJECTIVE 4

number

PAGE 12 OF 14

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Were cylinder valves cracked before attaching the regulators?..................	____	____
2. Was leak test performed using soap and water?.	____	____
3. Was tip positioned so that needle valves were on the side or bottom?.................	____	____

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 13 OF 14

DIRECTIONS:

Given access to metal, equipment, electrodes, and work station, you will set up portable Oxy-fuel equipment. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Was protective equipment worn or used:		
a. oxyacetylene goggles?		
b. gloves?		
c. striker?		
2. Were the oxygen and acetylene regulators obtained?		
3. Was twin hose in safe and usable condition?		
4. Was torch in working condition?		
5. Was No. 2 size tip used?		
6. Were cylinders secured to the cart?		
7. Were cylinder valves cracked before attaching the regulators?		
8. Was leak test performed using soap and water?		
9. Was tip positioned so that needle valves were on the side or bottom?		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

Instruictional Resource

Text

________, PAT Workbook, Hobart School of Welding Technology, Troy, Ohio, 1975.

Audiovisual

Beseler/Cue See Filmstrip System, Charles Beseler Company, Florham Park, New Jersey, 1977.

KNOWLEDGE TEST FOR ☐ ☐☐

duty task number

PAGE 1 OF 2

DUTY

TASK

DEPT.

PROG.

TASK: Set-up Portable Oxy-fuel Equipment

DIRECTIONS:

Evaluate your knowledge by answering the items below on a separate Answer Sheet.

DO NOT MARK ON THIS TEST!

The items below are True-False. On the separate Answer Sheet, put T if the item is True and F if the item is False.

1. Chains should be secured around and above the middle of the cylinder.
2. Protective caps should be removed before placing the cylinders on the tank truck.
3. Oxygen fittings have a groove machined in them to show they are left hand threads.
4. The correct oxygen line pressure is 15 to 20 PSI.
5. The oxygen cylinder valve should be opened all the way after pressure registers on the high pressure gauge.

The items below are Multiple-Choice. On the separate Answer Sheet, put the letter of the correct answer.

1. What is the maximum safe pressure of free acetylene?

   a. 5 PSI
   b. 10 PSI
   c. 15 PSI
   d. 20 PSI
   e. 30 PSI

2. Why should you not use oil or grease on oxygen fittings?

   a. oil or grease combined with oxygen can cause fire
   b. both will cause the wrench to slip off the fittings.
   c. because it will get on your hands
   d. because they collect dirt

3. What is the pressure of a full tank of oxygen?

   a. 244 PSI
   b. 540 PSI
   c. 2200 PSI
   d. 2400 PSI

KNOWLEDGE TEST FOR ☐ ☐☐

CONTINUED duty task number

PAGE 2 OF 2

DUTY

TASK

DEPT.

PROG.

4. When adjusting pressures for cutting, the oxyacetylene pressure should be:

   a. the same as for welding.
   b. more than for welding.
   c. less than for welding.
   d. doesn't matter.

5. What is the temperature range of the oxycetylene flame?

   a. 1000° to 1500°
   b. 1500° to 3000°
   c. 3000° to 4000°
   d. 4000° to 4900°
   e. 5900° to 6300°

True or False

1. T

2. F

3. F

4. T

5. T

Multiple-Choices

1. c

2. a

3. c

4. a

5. e

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 2 OPERATING ARC WELDING EQUIPMENT

TASK: 0 1 Run Short Beads

PURPOSE:

This task is basic to all shielded metal arc welding tasks to follow. It is very important that you learn how to strike and control the arc and run short beads correctly and safely. This task will help you attain the other tasks that follow in this duty.

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DUTY
TASK
PREREQ
DEPT.
PROG.
REVISED

DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: access to equipment, tools, metal, and work station,

YOU WILL: run short beads.

HOW WELL: You must successfully complete the Knowledge Test. Your performance will be assessed by your instructor using the Performance Standards on page 15.

ENABLING OBJECTIVES:

1. Recognize fundamentals and safety in shielded metal arc welding.
2. Identify steps for preparation of striking and controlling the arc and depositing short beads.
3. Prepare to strike and control arc and deposit short beads.
4. Practice striking and controlling the arc and depositing short beads.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE ☐ number

PAGE 4 OF 16

DUTY ☐ TASK ☐ EN. OBJ. ☐ DEPT. ☐ PROG. ☐

Enabling objective

Recognize fundamentals and safety in shielded metal arc welding.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to acquire knowledge of shielded metal arc welding and safety rules which should be practiced.	1. a. PAT Workbook, Topics 1 and 2. b. Beseler Cue/See, Topics 1 and 2.
2. Evaluate your knowldge by completing the Self-Check.	2. Self-Check enclosed.
3. Go on to Enabling Objective No. 2.	

SELF-CHECK FOR ENABLING OBJECTIVE ☐ number PAGE 5 OF 16

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

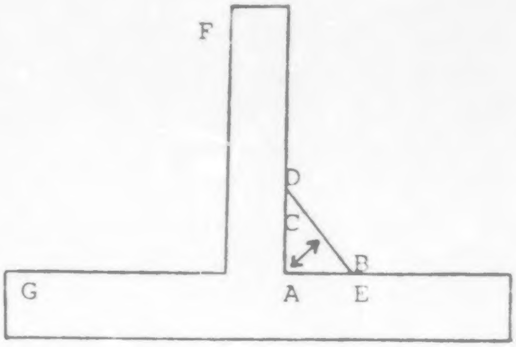
DIRECTIONS:
Evaluate your knowledge by answering the items below on a separate sheet of paper.

The items below are True-False. Answer T for True and F for False on a separate sheet of paper.

1. Two reasons why welding is preferred over bolting or riveting are that welding is faster and stronger.
2. AC welding machines are basically generator types.
3. A No. 10 shade lens is used for amperages up to 200 amps.
4. The electrode coating forms gases and slag to protect the hot metal from oxidizing.
5. Ultraviolet rays from the arc will not damage the skin.

The items below are Matching. Put the letter of the correct answer on a separate sheet of paper.

1. Throat
2. Toe
3. Face
4. Leg
5. Root



Now check your answers with the Answer Key.

SELF-CHECK FOR ENABLING OBJECTIVE ☐ number
ANSWER KEY

PAGE 6 OF 16

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

True-False

1. T
2. F
3. T
4. T
5. F

Matching

1. c
2. d
3. b
4. e
5. a

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE ☐ number

PAGE 7 OF 16

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Identify steps for preparation of striking and controling the arc and depositing short beads.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify equipment needed and to recognize steps in cleaning and setting up metal for task.	1. Instruction Sheet enclosed, Equipment Needed for Striking and Controlling the Arc
2. Read Resource No. 2 to identify steps in setting up the welding machine.	2. PAT Workbook, Topic 3, Items 1 and 2, pages 6-7.
3. Evaluate your knowledge by completing the Self-Check.	3. Self-Check enclosed.
4. Go on to Enabling Objective No. 5.	

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Equipment Needed for Striking and Controlling the Arc

1. Obtain the following items from your locker:
    - a. Welding helmet
    - b. Gloves
    - c. Wire brush
    - d. Chipping hammer

    Caution: CHECK FOR LENS BEING CRACKED AND EQUIPMENT WHICH IS IN BAD CONDITION!

2. Select an AC/DC arc welding machine.

3. Obtain the following items from the crib or metal storage are:
    - a. Scrap steel plate 1/4" or 3/8" thick
    - b. 1/8" E-6010 electrodes
    - c. Metal Tongs

CAUTION: CHECK TO ENSURE THAT ALL TOOLS ARE IN GOOD WORKING CONDITION!

1. Use a chipping hammer to remove slag along edges of the metal plate which was left from the cutting operation.

2. Clean the plate surface using a wire brush. Remove all rust, scale, etc.

3. Place the metal plate on the table in a flat position.

Instruction Sheet prepared by Richard L. Bausum.

SELF-CHECK FOR ENABLING OBJECTIVE ☐ number PAGE 9 OF 16

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your knowledge by answering True or False to the items below on a separate sheet of paper.

1. Reverse polarity means that the work (ground) is negative and the electrode is positive.
2. The heat or current required to melt the electrode is called amperage.
3. You should use a grinder to remove the slag along the edge of metal left by the cutting operation.
4. You will select an AC welding machine for welding E, 6010.
5. The surface of the metal to be welded should be cleaned of rust or oil before welding.

Now check your answers with the Answer Key.

1. T
2. T
3. F
4. F
5. T

All of your answers should agree with the answers on the Answer Key. If you missed any, go back and repeat one or more of the Learning Activities for this Enabling Objective.

ARNING ACTIVITIES FOR ENABLING OBJECTIVE ☐ number

PAGE 11 OF 16

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

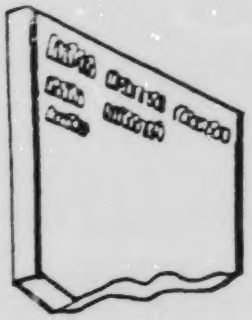
Enabling objective

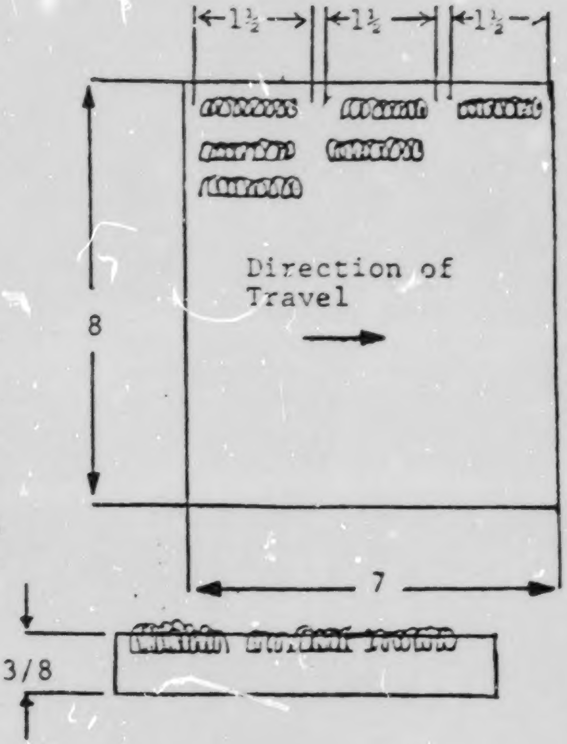
Prepare to strike and control arc and deposit short beads.

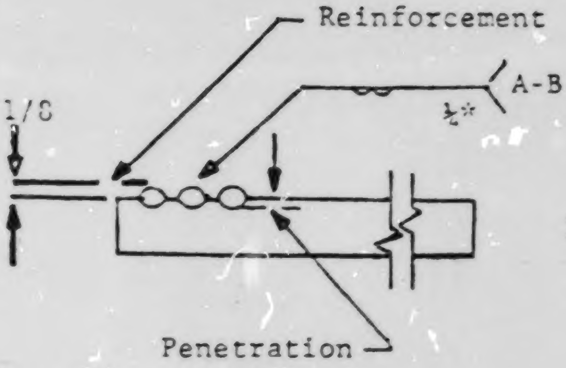
PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the steps in striking and controlling the arc and depositing short beads.	1. a. PAT Workbook, Topic 3, pages 8-12. b. Beseler Cue/See, Topic 3.
2. View Resource No. 2 to identify the procedure for positioning weld beads.	2. Instruction Sheet enclosed, Positioning Weld Beads.
3. When you think you can attain this task, take the Knowledge Test.	3. Knowledge Test.
4. Go on to Enabling Objective No. 4.	

Positioning Weld Beads




1½
1½
1½
8
Direction of Travel
7
3/8


Reinforcement
A-B
½*
1/8
Penetration

A - weld on both sides of plates

B - flat position

* - refers to bead width

Name: Positioning Weld Beads — Striking and Controlling the Arc

Electrode size: 1/8 diameter DC/RP Type: AWS E-6010			
Material:	Spec:	Amt:	Size:
Steel	Mild	1	3/8 x 8 x 7

Instruction Sheet prepared by Richard L. Bausum

11

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE ☐ number PAGE 13 OF 16

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Practice striking and controlling the arc and depositing short beads.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Assemble equipment needed to perform this task.	1. a. Locker b. Crib
2. Clean and setup work station.	2. a. Weld table b. Welding machine
3. Flame cut, clean, and setup metal for striking and controlling the arc and depositing short beads.	3. a. Oxyacetylene cutting outfit b. Metal c. Equipment
4. Strike and control arc and deposit short beads.	4. a. Work station b. Equipment c. Tools d. Metal
5. Evaluate your work by completing the Self-Check. Have your instructor check your work.	5. Self-Check enclosed.
6. When you think you can perform this task, take the Performance Test.	6. Performance Test.

SELF-CHECK FOR ENABLING OBJECTIVE ☐ number PAGE 14 OF 16

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Was each weld bead uniform in width and height for full length?	____	____
2. Was the bead ripple uniform?	____	____
3. Was the bead width approximately two times the electrode diameter?	____	____
4. Was undercutting kept to a minimum?	____	____
5. Were weld beads from left to right for a right handed person?	____	____
6. Was slag removed from each bead?	____	____

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 15 OF 16

DIRECTIONS:

Given access to equipment, tools, metal and a work station, you will deposit a series of short weld beads approximately 1 1/2" long. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were all welds beads approximately 1/4" in width?..........		
2. Were all weld beads uniform and rippled in appearance?..........		
3. Was the proper arc length held?..........		
4. Were beads from left to right for a right-handed person?..........		
5. Was slag removed from each bead?..........		
6. Were weld beads approximately 1 1/2" long?..........		
7. Were weld beads free of undercut?..........		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained
☐ Not attained

EVALUATOR

DEPT.

PROG.

LIST OF RESOURCES, MATERIALS, AND EQUIPMENT

PAGE 16 OF 16

DUTY

TASK

DEPT.

PROG.

Instructional Resources

Texts

-----, PAT Workbook, Hobart School of Welding Technology, Troy, Ohio, 1975.

Audiovisual

Beseler Cue/See Filmstrip System, Charles Beseler Company, Florham Park, New Jersey, 1977.

Materials

1/8" E-6010 electrodes
1/4" or 3/8" thick mild steel plate

Equipment

Hobart TR 300 AC/DC welding machine, Hobart Welding, Troy, Ohio.

KNOWLEDGE TEST FOR ☐ ☐☐

duty task number

PAGE ________ OF ________

DUTY | TASK | DEPT. | PROG.

TASK: Run Short Beads

DIRECTIONS:

Evaluate your knowledge by answering the items below on a separate sheet of paper.

DO NOT MARK ON THIS TEST!

The items below are Multiple Choice. On the separate Answer Sheet, put the letter of the correct answer on the blank to the left of the number of the question.

1. The electrical force that supplies the heat to melt the electrode is called:

   a. voltage.
   b. amperage.
   c. watts.
   d. polarity.

2. The length of the weld beads for this task should be approximately:

   a. 1 1/2inches long.
   b. 3 inches long.
   c. 5 inches long.
   d. 7 inches long.

3. The amperage range for a 1/8" E-6010 electrode is:

   a. 40-75 amps.
   b. 200-275 amps.
   c. 140-225 amps.
   d. 75-130 amps.

4. Proper weld bead width for a 1/8" E-6010 electrode is:

   a. 1/4".
   b. 1/8".
   c. 1/2".
   d. 3/4".

KNOWLEDGE TEST FOR ☐ ☐☐

CONTINUED duty task number PAGE ____ OF ____

DUTY | TASK | DEPT. | PROG.

5. Correct polarity for E-6010 electrodes is:

   a. AC/DC.
   b. DC straight.
   c. DC reverse.
   d. none of the above.

The items below are True-False. On the separate Answer Sheet, circle T if the item is True and F if the item is False.

1. A form of electric welding in which a bare welding rod is used is called a shielded arc welding.

2. Two reasons why welding is preferred over bolting or riveting are because welding is faster and stronger.

3. The slag along the edges of the plate left from cutting should be removed by grinding.

4. AC welding machines are basically generator types.

5. The two methods of starting an arc are: tapping motion and scratching motion.

6. A No. 10 shade lens is used for amperages up to 200 amps.

7. Proper arc length is three times the electrode diameter.

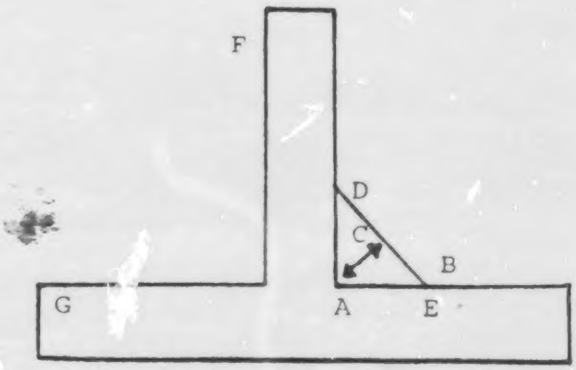
8. A right handed person metal arc welds from the left to the right.

9. The electrode coating forms gases and slag to protect the hot metal from oxidizing.

10. Ultraviolet rays from the arc will not damage skin.

The items below are Matching. On the separate Answer Sheet, put the letter of the item that best identifies each item.

1. Throat
2. Toe
3. Face
4. Leg
5. Root



17

Multiple Choice questions

.___1.
.___2.
.___3.
.___4.
.___5.
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True-False questions

T [✓ F] 1.
[✓ T] F 2.
T [✓ F] 3.
T [✓ F] 4.
[✓ T] F 5.
[✓ T] F 6.
T [✓ F] 7.
[✓ T] F 8.
[✓ T] F 9.
T [✓ F] 10.
T F 11.
T F 12.
T F 13.
T F 14.
T F 15.
T F 16.
T F 17.
T F 18.
T F 19.
T F 20.
T F 21.
T F 22.
T F 23.
T F 24.
T F 25.

Matching questions

.____1.
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STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 5 PERFORMING COMBINATION WELDING SKILLS

TASK: 0 2 Fabricate Products from Ferrous/Nonferrous Metals

PURPOSE:

As a welder, you may be required to fabricate and weld various types of storage devices. This learning guide will help you attain the necessary skills to perform this job.

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY
TASK
PREREQ.
DEPT.
PROG.

REVISED

DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:
(include condition, performance, and standard)

GIVEN: access to a blueprint, sketch or Instruction Sheet, tools, and equipment.

YOU WILL: fabricate products from ferrous/nonferrous metals.

HOW WELL: Your performance will be assessed by your instructor using the Performance Test on page 7.

ENABLING OBJECTIVES:

1. Layout, mark, and cut.
2. Assemble and weld.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number

PAGE ______ OF 8

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Layout, mark, and cut.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the procedure for laying out, marking, and cutting various parts.	1. Blueprint, sketch, or Instruction Sheet.
2. Layout, mark, and cut parts by following the procedure outlined in Resource No. 1.	2. a. Blueprint, sketch or Instruction Sheet. b. Tools c. Equipment
3. Evaluate your work by completing the Self-Check.	3. Self-Check enclosed.
4. Go on to Enabling Objecative No. 2.	

SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 5 OF 8

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

		YES	NO
1.	Were all measurements within the tolerances shown by the blueprint, sketch or Instruction Sheet?......................................	____	____
2.	Were angle cuts (if any) cut to the degrees shown by the blueprint, sketch or Instruction Sheet?..	____	____
3.	Were the number of pieces of each part cut as shown by the blueprint, sketch or Instruction Sheet?......................................	____	____
4.	Were the number of pieces of each part cut as shown by the blueprint, sketch or Instruction Sheet?......................................	____	____
5.	Were all parts needed for the assembly cut?......	____	____

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2

number

PAGE 6 OF 8

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Assemble and weld.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the procedure for assembling and welding all parts.	1. Blueprint, sketch or Instruction Sheet.
2. Assemble and weld all parts by following the procedure outlined in Resource No. 1. Have your instructor check your work.	2. a. Blueprint, sketch or Instruction Sheet. b. Tools c. Equipment d. Metal
3. When you think you can perform this task, take the Performance Test.	3. Performance Test.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 7 OF 8

DIRECTIONS:

Given access to a blueprint, sketch or Instruction Sheet, tools, and equipment, you will fabricate products from ferrous/nonferrous metals. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were dimensions within the tolerances shown by the blueprint, sketch or Instruction Sheet?..................		
2. Was the final assembly square, level, etc. as require by the blueprint, sketh or Instruction Sheet?...		
3. Were all welds made in accordance with blueprint, sketch, or Instruction Sheet?....................		
4. Was all slag and weld splatter removed from the finished assembly?..............................		
5. Were welds ground flush where required?..................		
6. Were critical dimensions within tolerance?................		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

LIST OF RESOURCES, MATERIALS, AND EQUIPMENT

PAGE 8 OF 8

DUTY	TASK	DEPT.	PROG.

No additional resources required.

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: A COMPLETING CORE CURRICULUM

TASK: 2 1 Participate in Job Interview

DRAFT

PURPOSE:

How well you represent yourself in an interview will determine whether or not you are hired. The ability to "sell yourself" is the key to landing a job. A successful job seeker knows how to make an important first impression.

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY	A
TASK	21
PREREQ	
DEPT.	IN
PROG.	9943
REVISED	

THE SCHOOL BOARD OF PALM BEACH COUNTY

DEPARTMENT OF VOCATIONAL-TECHNICAL EDUCATION

North Technical Education Center
7071 Garden Road
Riviera Beach, Florida 33404

South Technical Education Center
1300 S. W. 30th Avenue
Boynton Beach, Florida 33435

West Technical Education Center
2625 State Road 715
Belle Glade, Florida 33430

E. Miles Bacon, Director of Vocational-Technical Education

Wilma McCarty, Curriculum and Staff Development Specialist

THIS STUDENT LEARNING GUIDE WAS DEVELOPED BY:

Vince Repper, Welding Instructor
North Technical Education Center

Jim Schmidt, Welding Instructor
South Technical Education Center

Joe Smith, Welding Instructor
West Technical Education Center

This student learning guide was adapted from the VIMAS Decentralized Welding Project funded through the Florida Department of Education.

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OBJECTIVES PAGE 3 OF 16

DUTY A
TASK 21
DEPT. IN
PROG. 9943

PERFORMANCE OBJECTIVE:
(Include condition, performance,
and standard)

GIVEN: access to a prospective employer,

YOU WILL: participate in job interview.

HOW WELL: Your performance will be assessed by your instructor using the Performance Test on pages 14-15.

ENABLING OBJECTIVES:

1. Identify making a good first impression.
2. Practice preparing for a job interview.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1

number

DUTY A
TASK 21
EN. OBJ. 1
DEPT. IN
PROG. 9943

Enabling objective:

Identify making a good first impression.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify positive points for interviewing and points evaluated during an interview.	1. a. Employability Skills Series: "Applying For a Job", pages 64-71. b. Instruction Sheet enlcosed, Positive Points for Interviewing c. Instruction Sheet enclosed, Interviewer's Evaluation Sheet
2. Practice answering possible interview questions.	2. Employability Skills Series: "Applying For a Job", page 77.
3. Evaluate your knowledge by completing the Self-Check. Have your instructor check your work.	3. Self-Check enclosed.
4. Go on to Enabling Objective No. 2.	

Positive Points for Interviewing

arefully read this material and concentrate on the positive points.

OSITIVE POINTS

1. Being neat and clean with a sharp appearance will make a good first impression.
2. Willing to accept beginning job requirements and conditions.
3. Willing to accept beginning salary; has checked salary for the type of job.
4. Demonstrating maturity, poise, self-confidence, courtesy, tact, and advanced preparation.
5. Arriving for the interview on time, even a few minutes early.
6. Coming to the interview alone.
7. Knowing about the company and how you can fit into the organization.
8. Having given some thought to the occupational goals and plans; having an understanding of the relationship of this job to these goals and plans.
9. Asking and answering questions intelligently.
10. Having a pleasant manner and being a good listener.
11. Expressing yourself well.
12. Showing interest and enthusiasm.
13. Having a good or acceptable school record.
14. Being open, honest, and straightforward about any questionable factors in the record.
15. Avoiding criticism of others.
16. Giving the appearance of good health.
17. Looking the interviewer in the eye while talking.
18. Having a firm handshake.

19. Appearing to be industrious and eager to work.

20. Indicating tolerance.

Interviewer's Evaluation Sheet

Some employers use evaluation sheets to rate a candidate as a possible new employee. Study the sample evaluation sheets shown below.

	Excellent	Good	Fair	Poor
1. Stability................				
2. Ability to Get Along With Others.................				
3. Leadership...............				
4. Motivation...............				
5. Appearance...............				
6. Manners..................				
7. Intelligence.............				

Applicant Status

Overall Rating

Satisfactory__________

Questionable__________

Unsatisfactory__________

Make job offer of:__________

Under consideration, but wish to interview more

Not under consideration, because:__________

Applicant's name:__________

Position interviewed for:__________

Interviewing supervisor:__________

Department:__________ Date:__________

SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 8 OF 16

DUTY
TASK
EN. OBJ.
DEPT.
PROG.

DIRECTIONS:

Evaluate your knowledge by answering the items below on a separate sheet of paper.

1. Assuming that a job opening exists and that an applicant is qualified for a particular job, list as many reasons as you can that might cause the applicant to lose out on the job because of the actions of the applicant during the interview.
2. What are some of the factors that interviewers consider in rating an applicant?
3. What do you consider the most important point at the time of the interview?

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 9 OF 16

DUTY A
TASK 21
EN. OBJ. 2
DEPT. IN
PROG. 9943

Enabling objective:

Practice preparing for a job interview.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Use Resource No. 1 to identify the do's and don'ts of interviewing.	1. Employability Skills Series: "Applying For a Job", pages 79 92.
2. Assemble interview portfolio.	2. Instruction Sheet enclosed, Interview Portfolio
3. Use Resource No. 3 to identify the items to bring with you to an interview.	3. Instruction Sheet enclosed, Mock Interview
4. Read Resource No. 4 to identify the qualities of a follow-up letter.	4. a. Employability Skills Series: "Applying For a Job", pages 93-98. b. Instruction Sheet enclosed, Sample Follow-up Letter
5. Evaluate your knowledge by completing the Self-Check. Turn your letter in to your instructor.	5. a. Employability Skills Series: "Applying For a Job", page 100.
6. As a Performance Test for interviewing, participate in a mock interview and write a follow up letter to be mailed to the interviewer. Your performance will be rated according to Resource No. 6.	6. Performance Test for task 2-21.

DUTY A TASK 21 EN. OBJ. 2 DEPT. IN PROG. 9943

Interview Portfolio

Another way to sell yourself in a job interview is to prepare an interview portfolio. This is a notebook of your achievements, interests, and goals.

It serves the following purposes:

1. Shows organization.
2. Tells what you have done and can do.
3. Very effective if you are shy, your work can do the talking.

This portfolio is taken with you on an interview. It is a binder containing all papers necessary to effectively improve your chances of getting a job. The contents may be indexed for easy reference to specific areas of your training. Items in the portfolio may include the resume, samples of work, awards, certificates, commendations, and letters of recommendation.

This portfolio should be revised as you gain experience and training.

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 2 number PAGE 11 OF 16

DUTY A
TASK 21
EN. OBJ. 2
DEPT. IN
PROG. 9943

Mock Interview

Listed below are the steps to follow in preparing for an interview.

1. Make an appointment with your instructor.
2. Follow the recommendations for a good interview found in this guide.
3. Be sure to bring your resume portfolio with you at the time of the interview.
4. Treat this as a serious procedure.
5. Remember, dress for the interview as if you [illegible] going on an actual interview.
6. You will be rated according to:
    a. personal appearance
    b. actual interview
    c. attitude

REMEMBER: YOU NEVER GET A SECOND CHANCE TO MAKE A FIRST IMPRESSION!

SELF-CHECK FOR ENABLING OBJECTIVE 2 number PAGE 12 OF 16

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

	YES	NO
1. Was arrangement easy to read?...........................	___	___
2. Was arrangement logical?................................	___	___
3. Was letter courteous?...................................	___	___
4. Was letter concise?.....................................	___	___
5. Was the position applied for mentioned?.................	___	___
6. Was the day of the interview mentioned?.................	___	___
7. Were errors or erasures eliminated, if letter was typed?..	___	___

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

Sample Follow-up Letter

To strengthen the possibility of getting the job you applied for, write a letter of thanks. A successful applicant writes concise, courteous letters to follow-up an interview.

123 Orange Drive
Fort Lauderdale, Florida 33065
February 6, 1983

Mr. Jim Jones
Levitz Manufacturing, Inc.
140 Industrial Park
Tallahassee, Florida 32301

Dear Mr. Jones:

Thank you for taking the time to talk with me on Friday about the welding job in your welding shop.

My recent course in Palm Beach County has given me the qualifications necessary for this position.

I look forward to hearing from you. If any additional information is needed, please telephone me at 555-3478.

Sincerely,

Randy Jackson

Randy Jackson

BEST COPY AVAILABLE

PERFORMANCE TEST FOR B | 0 | 1

duty task number

PAGE 14 OF 16

DIRECTIONS:

Given access to an interviewing situation, you will prepare for a job interview. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Was applicant clean with a neat hairstyle?		
2. Were teeth clean?		
3. Were hands and nails clean?		
4. Was hair clean?		
5. Was applicant dressed appropriately?		
6. Were shoes clean?		
7. Was good standing and sitting posture used?		
Interview		
1. Was interviewer promptly greeted and called by name by the applicant, such as Mr. Smith?		
2. Was the applicant's name stated?		
3. Was the purpose of the call stated?		
4. Was the applicant ready to shake hands when the interviewer offfered to do so?		
5. Was the applicant standing until invited to sit down?		
6. Was the applicant erect, yet comfortable while sitting?		
7. Were hands, elbows, and papers kept off the desk?		
8. Was applicant polite and courteous without overdoing it?		

BEST COPY AVAILABLE

DUTY A
TASK 21
ATTEMPT
STUDENT
DATE
☐ Attained
☐ Not attained
EVALUATOR
DEPT. IN
PROG. 9943

PERFORMANCE TEST FOR B | 0 1

CONTINUED — duty — task number

PAGE 15 OF 16

PERFORMANCE STANDARDS

ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
9. Was gum chewing eliminated?		
10. Was brief, accurate information supplied to all questions?		
11. Were answers well thought out?		
12. Was applicant careful not to monopolize interview?		
13. Were pertinent questions asked concerning the job?		
14. Were clear answers secured in regard to wages?		
15. Was any impression avoided in regard to wages?		
16. Was an answer secured as to whether further consideration would be given?		
17. Was the applicant calm throughout the interview?		
18. Was correct English used?		
19. Was self-confidence displayed?		
20. Was the applicant a good listener?		
21. Was the applicant interested and enthusiastic?		
22. Were annoying mannerisms avoided?		

DUTY A
TASK 21
ATTEMPT
STUDENT
DATE
☐ Attained
☐ Not attained
EVALUATOR
DEPT. IN
PROG. 9943

Instructional Resources

Texts

State of Florida, Department of Education, Employability Skills Series: Applying For a Job, State of Florida, Department of State, Tallahassee, Florida, 1979.

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: A COMPLETING CORE CURRICULUM

TASK: 1 6 Perform Punching Operations with Power Equipment

PURPOSE:

The iron worker is a machine that can shear, punch, and bend metal. This is a useful time saving machine for any shop. This learning guide will assist you in learning how to operate this machine in different ways.

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY

TASK

PREREQ.

DEPT.

PROG.

REVISED

PERFORMANCE OBJECTIVE:
(Include condition, performance, and standard)

GIVEN: access to an iron worker, tools, and metal,

YOU WILL: perform punching operations with power equipment.

HOW WELL: You must successfully complete the Knowledge Test. Your performance will be assessed by your instructor using the Performance Test on page 10.

ENABLING OBJECTIVES:

1. Prepare to shear and punch metal with iron worker.
2. Shear metal with iron worker.
3. Punch metal with iron worker.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1

number

PAGE 4 OF 11

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Prepare to shear and punch metal with iron worker.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to identify safety precautions and steps in operating the iron worker.	1. Pamphlet: Iron Worker Instruction Manual, pages 1-4.
2. Read Resource No. 2 to identify the steps in shearing metal.	2. Instruction Sheet enclosed, Shearing Metal
3. Read Resource No. 3 to identify the procedure for punching metal.	3. Instruction Sheet enclosed, Punching Metal
4. When you think you can attain this task, take the Knowledge Test.	4. Knowledge Test.
5. Go on to Enabling Objective No. 2.	

Shearing Metal

1. The iron worker will shear angle iron and flat metal.

2. To shear angle iron each piece has to be marked individually.

3. If cutting pieces from a length of more than 3', a stand should be placed under the longer length for support. This makes the metal align with the cutting blade for a straight cut.

4. The tri-square is used to mark the inside of the angle iron.

5. The angle iron is sheared with the inside of the angle face up.

6. The shear blade must strike the interval vertex of the angle between the 6" and 6 1/4" mark to make the proper cut.

7. The maximum cut for this machine is 3" x 3" x 5/16" angle.

8. Sheet metal is sheared without waste, so the cutting blade must strike the metal on the marked line.

9. Sheet metal is sheared without waste, so the cutting blade must strike the metal on the marked line.

10. "C" clamps should be used to hold the metal in place after being squared to insure a straight cut.

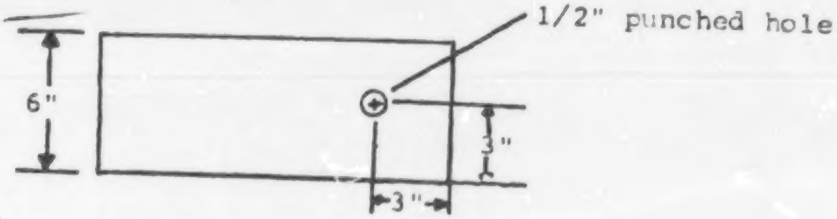
11. Maximum shearing capacity is not to exceed 3/8" for mild steel.

CAUTION: KEEP HANDS AND LOOSE CLOTHING AWAY FROM MACHINE BEFORE STARTING THE SHEARING ACTION.

CAUTION: NEVER USE YOUR HANDS TO HOLD OR RETRIEVE METAL UNLESS THE MACHINE IS TURNED OFF!

Punching Metal

1. Determine the hole size needed; then install proper punch and die.
2. Support stands must be used if the metal being punched exceeds 3' in length.
3. Thickness of plate to be punched for this machine is not to exceed 3/8".
4. To punch sheet metal, the metal must be measured and marked from one side and one end to get the location of the hole.
5. The metal is then placed over the die so the punch will strike the center of the crosslines. Hold in center of punched hole and apply punch pressure through material.



6. To punch angle iron, follow the procedure listed above.

CAUTION: IF ANGLE IRON IS SET IN TOO CLOSE TO THE STRIPPER AND PUNCH, THE BARREL GUIDE WILL STRIKE THE VERTICAL PART OF THE ANGLE CAUSING DAMAGE TO THE MACHINE AND ANGLE IRON.

7. Upon completion of this, clean oil from the machine and return tools to crib.

Instruction Sheet prepared by Richard L. Bausum.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number

PAGE 7 OF 11

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Shear metal with iron worker.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. See instructor for a job of shearing metal. Using Resource No. 1, shear metal with iron worker.	1. a. Metal b. Iron worker
2. Complete the Self-Check. Have your instructor check your work.	2. Self-Check enclosed.
3. Go on to Enabling Objective No. 3.	

SELF-CHECK FOR ENABLING OBJECTIVE 1 number PAGE 8 OF 11

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS: Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Was the condition of the machine checked?.......		
2. Were cutting blades lubricated with cutting oil?		
3. Was angle iron marked allowing for waste?......		
4. Was sheet metal squared on work table?.........		
5. Were support stands used for angle and sheet metal?..		
6. Were clamps used to secure sheet metal before each cut?....................................		
7. Was machine cleaned of waste and oil?..........		

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 9 OF 11

DUTY	TASK	EN. OBJ.	DEPT.	PROG.

Enabling objective:

Punch metal with iron worker.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. See instructor for a job of punching metal. Using Resource No. 1. Practice punching metal with iron worker. Have your instructor check your work.	1. a. Metal b. Iron worker
2. When you think you can perform this task, take the Performance Test.	2. Performance Test.

8

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 10 OF 11

DIRECTIONS:

Given access to equipment, materials, and a work station, you will perform punching operations with power equipment. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Was the tri-square used?..		
2. Was the metal aligned?..		
3. Were the metal aligned?..		
4. Were support stands used?..		
5. Were blades and punch lubricated?..		
6. Was the condition of the machine checked?..		
7. Was the metal kept from piling up under the shear blade?..		
8. Was machine cleaned and tools returned to the crib?........		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained
☐ Not attained

EVALUATOR

DEPT.

PROG.

DUTY

TASK

DEPT.

PROG.

Instructional Resources

Texts

---, Dvorak Iron Wroker Instruction Manual, Little Scotchman Industries, Philip, South Dakota.

KNOWLEDGE TEST FOR ☐ ☐☐

duty task number

PAGE 1 OF 1

TASK: Perform Punching Operations with Power Equipment.

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet, put T if the item is True and F if the item is False.

DO NOT MARK ON THIS TEST!

DUTY

TASK

DEPT.

PROG.

1. This machine can shear 3/4" thick metal.
2. Lubrication is needed only once.
3. The metal thickness can not exceed the diameter of the punch.
4. Cutting angle iron has 1/4" of waste per cut.
5. There is 1/8" of waste metal when shearing the sheet metal.
6. Angle iron can only be measured and sheared one piece at a time.
7. All cuts have to be measured and squared before cutting.
8. "C" clamps can be used to hold metal in place.

. . . .

Perform Punching Operations with Power Equipment.
Answer Key
True or False

1. F.

2. F

3. T

4. T

5. F

6. F

7. T

8. T

STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM: WELDING

DUTY: 2 OPERATING ARC WELDING EQUIPMENT

TASK: 0 4 Weld Multiple Pass Tee Joints: Horizontal Position

PURPOSE:

DRAFT

The tee joint (inside corner) is the most common type of weld the welder will encounter because little or no joint preparation is required. It is most important that you acquire the manipulative skill necessary to weld the tee joint in the horizontal position.

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY 2
TASK 04
PREREQ.
DEPT. IN
PROG. 9943
REVISED

OBJECTIVES PAGE 3 OF 12

DUTY 2
TASK 04
DEPT. IN
PROG. 9943

PERFORMANCE OBJECTIVE:
(Include condition, performance,
and standard)

GIVEN: access to equipment, tools, metal, and a work station,

YOU WILL: weld multiple pass tee joints: horizontal position.

HOW WELL: You must successfully complete the Knowledge Test.

Your performance will be assessed by your instructor using the Performance Test on page 11.

ENABLING OBJECTIVES:

1. Set-up station and tackweld tee joint.
2. Make 3-pass and 6-pass welds.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1

number

PAGE 4 OF 12

DUTY 2

TASK 04

EN. OBJ. 1

DEPT. IN

PROG. 9943

Enabling objective:

Set-up station and tackweld tee joints.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No, 1 to identify the steps in tackwelding tee joints.	1. Instruction Sheet enclosed, Setting Up Work Station and Tackwelding Tee Joints
2. Set-up work station and tackweld two sets of tee joints. Have your instructor check your work.	2. a. Equipment b. Tools c. Materials - 2 pieces of 1/4" x 3" x 8" mild steel plate and 4 pieces of 1/4" x 1½" x 8"
3. Go on to Enabling Objective No. 2.	

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 1 number PAGE 5 OF 12

DUTY 2
TASK 04
EN. OBJ. 1
DEPT. IN
PROG. 9943

Setting Up Work Station and Tackwelding Tee Joints

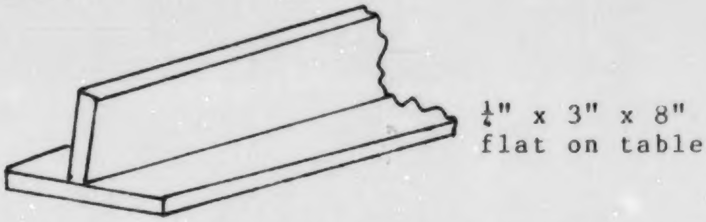
TTING SET UP:

AUTION: BE SURE MAIN ELECTRICAL SWITCH IS IN OFF POSTION.

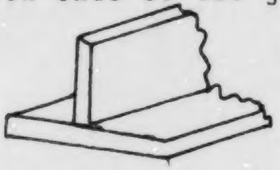
1. Inspect electrode holder, ground clamp and cables for:
   a. broken or loose insulators
   b. loose wires
   c. cracked or cut insulation
2. Clean weld table and attach ground clamp.
3. Set welding machine for proper polarity and amperage.

TEPS:

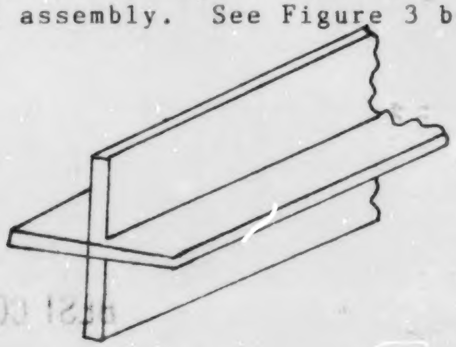
1. Place one piece 1/4" x 3" x 8" metal flat on table.
2. Place one piece 1/4" x 1½" x 8" on edge in approximate center of 3" wide piece to form an upside down "T". See Figure 1 below.



3. Turn on main electrical switch and turn on welding machine.
4. Securely tackweld both ends of tee joint. See Figure 2 below.



5. Turn assembly over and tackweld remaining 1½" wide piece on opposite side of assembly. See Figure 3 below.



6. Tackweld second set of tee joints in same manner.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2 number

PAGE 6 OF 12

DUTY 2 | TASK 04 | EN. OBJ. 2 | DEPT. IN | PROG. 9943

Enabling objective

Make 3-pass and 6-pass welds.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 explaining the steps in welding 3-pass tee joints.	1. Instruction Sheet enclosed, Welding 3-Pass Tee Joints
2. Make 3-pass welds on one set of tee joints you just tackwelded.	2. Tackwelded tee joints
3. Evaluate your work by completing the Self-Check. Have your instructor check your work.	3. Self-Check enclosed.
4. Read Resource No. 4 explaining how to weld 6-pass tee joints.	4. Instruction Sheet enclosed, Welding 6-Pass Tee Joints
5. Make 6-pass welds on the second set of tee joints you tackwelded.	5. Tackwelded tee joints
6. Evaluate your work by completing the Self-Check. Have your instructor check your work.	6. Self-Check enclosed.
7. When you think you can attain this task, take the Knowledge Test.	7. Knowledge Test for task 2-14.
8. When you successfully complete the Knowledge Test, take the Performance Test.	8. Performance Test for task 2-14.

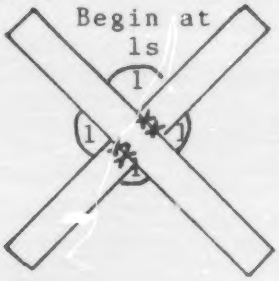
BEST COPY AVAILABLE

Welding 3-Pass Tee Joints

STEPS:

1. Make all four root passes (1). A root pass is the first pass in the bottom of the joint.

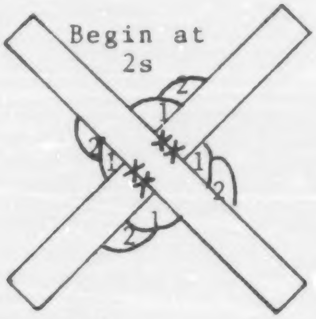
   NOTE: Begin at 1s. Rotate workpiece to make each bead in the flat position. This will control distortion. Distortion is a twisting or warping of the members being joined. It can be controlled by correct weld bead sequence. See Figure 1 below.



Rotate workpiece to make next bead in flat position.

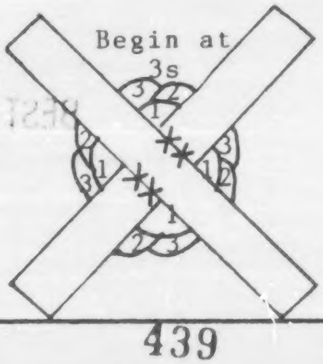
2. Make all four 2nd passes (2).

   NOTE: Begin at 2s. Rotate workpiece just like you did for root passes. See Figure 2 below.



3. Make all four 3rd passes (3).

   NOTE: Begin at 3s. Rotate workpiece just as you did before. See Figure 3 below.



SELF-CKECK FOR ENABLING OBJECTIVE 2

number

PAGE 8 OF 12

DUTY 2 | TASK 04 | EN. OBJ. 2 | DEPT. IN | PROG. 9943

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper,

All items should receive a "YES" response.

	YES	NO
1. Were the leg lengths of all welds approximately equal?...	___	___
2. Was surface ripple of all weld beads uniform?...........	___	___
3. Were welds free of undercut and porosity?...............	___	___
4. Were craters at the end of weld beads filled in?.........	___	___
5. Was distortion held to a minimum?........................	___	___

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

Welding 6-Pass Tee Joints

STEPS:

1. Make all four 1st, 2nd, and 3rd passes just as you did for the 3-pass welds.

2. Make all four 4th passes (4).

   NOTE: Begin at 4s. Rotate workpiece just as you did for the 3-pass. See Figure 4.

3. Make all four 5th passes (5) and then all four 6th passes (6) following the same procedure. See Figures 5 and 6.

Figure 4

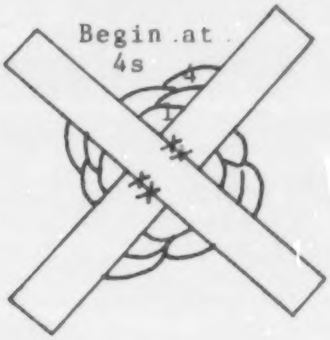


Figure 5

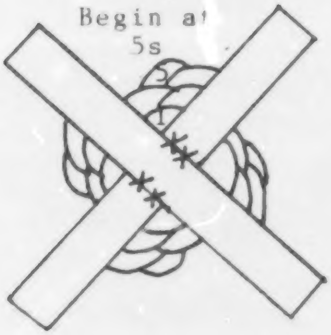
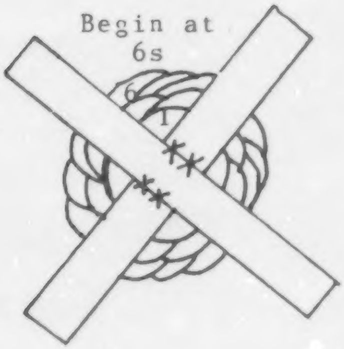


Figure 6



SELF-CKECK FOR ENABLING OBJECTIVE 2 number PAGE 10 OF 12

DUTY 2
TASK 04
EN. OBJ. 2
DEPT. IN
PROG. 9943

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Were the leg lengths of welds approximately equal?...................		
2. Was there a minimum of distortion in the workpiece?..................		
3. Were the weld beads free of undercut and porosity?...................		
4. Were the craters all filled?...		
5. Were the welds the same size from end to end?........................		
6. Were the weld beads free of slag?....................................		
7. Was the surface ripple of all beads uniform?.........................		
8. Was the throat size of all welds approximately equal?................		

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR 2 | 0 4

duty | task number

PAGE 11 OF 12

DIRECTIONS:

Given access to equipment, metal, electrodes, and work station, you will weld multiple pass tee joints: horizontal position. You will be evaluated for attainment of this task, based upon the items listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were the leg lengths of all 3-pass welds approximately equal?		
2. Were welds free of undercut and porosity?		
3. Were finished welds approximately the same size from end to end on each workpiece?		
4. Was distortion held to a minimum?		
5. Were craters filled in?		
6. Were throat sizes of all 6-pass welds approximately equal?		
7. Was surface ripple of all weld beads uniform?		

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DUTY 2

TASK 04

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT. IN

PROG. 9943

Instructional Resources

No additional resources required.

Materials

Mild steel plate, E-6010 or E-7018 electrodes

KNOWLEDGE TEST FOR 2 (duty) 04 (task number)

PAGE 1 OF 1

DUTY 2
TASK 04
DEPT. IN
PROG. 9943

TASK: Weld Multiple Pass Tee Joints: Horizontal Position

DIRECTIONS:

The items below are True-False. On the separate Answer Sheet, circle T if the item is True and F if the item is False.

DO NOT MARK ON THIS TEST!

1. It is NOT necessary to tackweld both ends of the workpiece to make a tee weld.
2. The amperage range for a 1/8" E-6010 electrode is 75-130 amps.
3. E-6010 electrodes work as well on DCSP as DCRP.
4. Travel speed is of little importance when welding a tee joint.
5. Distortion can be a major problem if you weld one side of a tee joint completely before welding on the opposite side.
6. Electrode angle has nothing to do with undercutting.
7. To make the best multiple-pass weld, the slag should be removed before making another pass.
8. Holding too long an arc length will cause excess weld splatter.

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KNOWLEDGE TEST ANSWER KEY

DUTY 2 | TASK 04 | DEPT. IN | PROG 9943

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ue-False questions

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[✓ F] 3.
[✓ F] 4.
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STUDENT LEARNING GUIDE

THE SCHOOL BOARD
OF PALM BEACH COUNTY, FLORIDA

PROGRAM:		WELDING
DUTY:	2	OPERATING ARC WELDING EQUIPMENT
TASK:	0 6	Weld Butt Joints: Flat Position

PURPOSE:

Many fabrication and structural jobs require that a welder be able to perform butt welds in $\frac{1}{4}$" thick metals. Therefore, it is most important that you become competent in this task so that you can make this type of weld when necessary.

DRAFT

PLEASE DO NOT WRITE IN LEARNING GUIDE

DUTY

TASK

PREREQ.

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PROG.

REVISED

OBJECTIVES PAGE 3 OF 12

DUTY

TASK

DEPT.

PROG.

PERFORMANCE OBJECTIVE:
(Include condition, performance,
and standard)

GIVEN: access to equipment, tools, metal and a work station,

YOU WILL: weld butt joints: flat position.

HOW WELL: Your performance will be assessed by your instructor using the Performance Test on page 11.

ENABLING OBJECTIVES:

1. Prepare to weld butt joints in the flat position.
2. Tackweld and weld butt joints in the flat position.

LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 1 number

PAGE 4 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective:

Prepare to weld butt joints in the flat position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. Read Resource No. 1 to determine how to tackweld butt joints.	1. Instruction Sheet enclosed, Tackwelding Butt Joints
2. Read Resource No. 2 to determine how to weld a butt joint.	2. Instruction Sheet enclosed, Welding Butt Joints
3. See instructor for oral questioning before continuing to Learning Activity No. 4.	3. Instructor
4. Go on to Enabling Objective No. 2.	

Tackwelding Butt Joints

1. Clean metal plates and welding table if necessary.
2. Adjust welding machine for 1/8" E-6010 electrodes.

   Note: Amperage will need to be set 10 to 15 amps higher than for other weld joints with 1/4" metal thickness.
3. Place two plates flat on welding table with 8" lengths together.
4. Space plates 1/8" apart (use bare end of electrode to measure).
5. Tackweld approximately 1/2" in from left edge of plates.
6. Recheck space on other end of plates and tackweld approximately 1/2" if from right edge of plates.
7. Make a third tackweld in the approximate center of the plates.
8. Tackweld the remaining plates to this assembly using the same procedure.
9. You should have five plates tackwelded together to form four butt joints.

INSTRUCTION SHEET FOR ENABLING OBJECTIVE 1 number PAGE 6 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Welding Butt Joints

1. Remove all slag from the tackwelds.

2. Position the workpiece on pieces of scrap metal to raise the weld joints above the welding table surface. This will prevent welding the workpiece to the welding table.

3. Position the workpiece with the tackwelds down or on the bottom side of the workpiece.

4. Strike the arc approximately ½" in from the left edge of one weld joint. Quickly move electrode to left edge of weld joint and establish required arc length and electrode angle. See Figures 1 and 2 below.

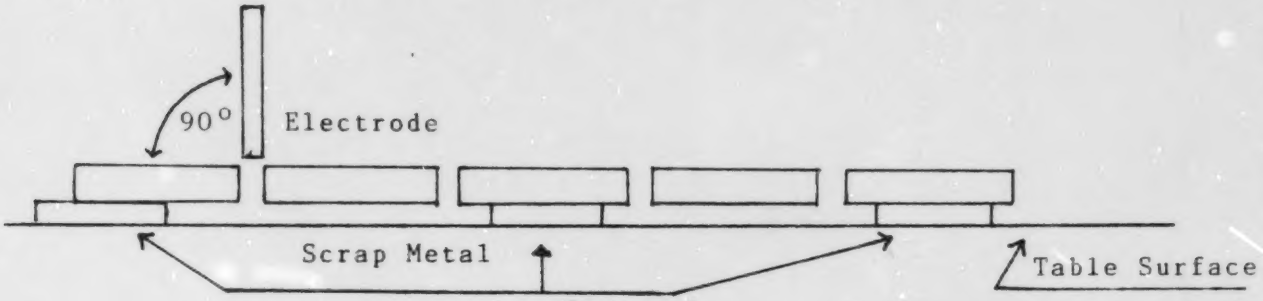


Figure 1

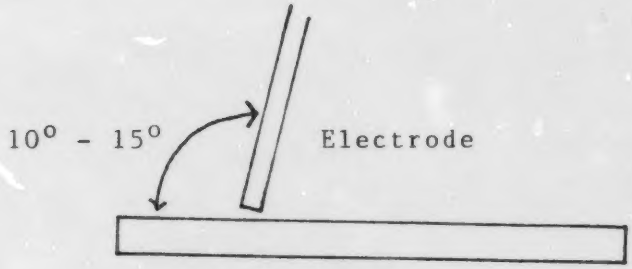
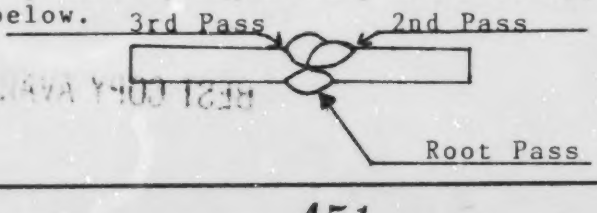


Figure 2

5. Use a whipping motion and carry a keyhole to deposit the root bead. Try to obtain 100% penetration for full length of joint.

6. Remove all slag.

7. Make the cover passes by depositing two overlapping stringer beads. See Figure 3 below.



8. Remove all slag.
9. Weld three remaining butt joints by following the same procedure.

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LEARNING ACTIVITIES FOR ENABLING OBJECTIVE 2

number

PAGE 8 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

Enabling objective

Tackweld and weld butt joints in the flat position.

PROCEDURE

LEARNING ACTIVITIES	RESOURCES
1. See instructor for your job of welding butt joints in the flat position.	1. Instructor
2. Tackweld butt joints.	2. a. Work station b. Equipment c. Tools d. Material - five pieces of 1/4" x 2" x 8" mild steel plate
3. Evaluate your work by completing Self-Check #1.	3. Self-Check #1 enclosed.
4. Weld butt joints.	4. a. Work station b. Equipment c. Tools d. Material
5. Evaluate your work by completing Self-Check #2.	5. Self-Check #2 enclosed.
6. Have instructor check your work.	6. Instructor
7. When you think you can perform this task, take the Performance Test.	7. Performance Test

SELF-CHECK FOR ENABLING OBJECTIVE 2 number PAGE 9 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Were five plates tackwelded together to form four butt joints?..	___	___
2. Were three tackwelds on each butt joint?.................	___	___
3. Was there approximately 1/8" space in each butt joint?....	___	___

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

SELF-CHECK FOR ENABLING OBJECTIVE 2 number PAGE 10 OF 12

DUTY

TASK

EN. OBJ.

DEPT.

PROG.

DIRECTIONS:

Evaluate your work by answering the items below on a separate sheet of paper.

All items should receive a "YES" response.

	YES	NO
1. Was there 100% penetration on all weld joints?............	___	___
2. Were the weld joints full from end to end?...............	___	___
3. Was there a minimum of undercut?.........................	___	___
4. Were all butt joints welded completely?..................	___	___

If you received a "NO" response for any item, go back and repeat one or more of the Learning Activities for this Enabling Objective.

PERFORMANCE TEST FOR ☐ ☐☐

duty task number

PAGE 11 OF 12

DIRECTIONS:

Given access to equipment, tools, metal and a work station, you will make the setups needed to weld a series of multiple pass butt joints in the flat position. You will be evaluated on attainment of this task, based upon the tiems listed below.

PERFORMANCE STANDARDS ALL ITEMS MUST BE MARKED YES FOR ATTAINMENT	YES	NO
1. Were the tackwelds on the root side of the weld?		
2. Were the welds penetrated 100% without excessive melt-through?		
3. Were the plates tackwelded in three places?		
4. Were the weld joints full from end to end?		
5. Were the weld faces convex and slightly above the plate		
6. Was there a minimum of undercut?		
7. Was all slag removed?		
8. Was the surface ripple of the weld beads uniform?		
9. Were there two overlapping beads on the cover weld?		
10. Was the work station secured?		

DUTY

TASK

ATTEMPT

STUDENT

DATE

☐ Attained

☐ Not attained

EVALUATOR

DEPT.

PROG.

LIST OF RESOURCES, MATERIALS, AND EQUIPMENT

PAGE 12 OF 12

DUTY
TASK
DEPT.
PROG.

No additional resources required.